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VARIABLE GEOMETRY SHROUDED PROPELLER TEST PROGRAM

FINAL REPORT

VOLUME II

TEST DATA

8 May 1968

Prepared under Contract N00019-67-C-0087 for the Naval Air Systems Command, Department of the Navy by Hamilton Standard, Division of United Aircraft, Windsor Locks, Connecticut.

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Report F331012-1

Wind Tunnel Tests of Variable Geometry Shrouded Propellers

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Report F331012-1

Wind Tunnel Tests of Variable Geometry Shrouded Propellers

SUMMARY

Wind tunnel tests of variable geometry shrouded propeller models were conducted for the Hamilton Standard Division of the United Aircraft Corporation in the 18-ft and 8-ft test sections of the UARL Large Subsonic Wind Tunnel during the period from May 1 to May 18, 1967. The test model comprised a shroud propeller assembly which was attached to a propeller dynamometer through strain gage balances. The balances provided shroud chord force, propeller thrust and propeller torque data. Various pressure measurements were also obtained including shroud inlet pitot-static pressures, shroud exit total pressures, shroud surface pressure distributions, and velocity-angularity radial traverse probe data. These data were obtained for three shroud configurations and two sets of propellers. Shroud variables included lip contour, length and exit area; propeller variables included blade planform and blade-shroud tip clearance. Test data for these model configurations were obtained through ranges of blade rotational speed at various blade pitch angles and at tunnel Mach numbers from 0.02 to 0.60.

A complete transcript of preliminary performance test data and descriptive information pertinent to the test models, equipment and techniques was forwarded to Hamilton personnel by June 19, 1967. Post-test efforts were suspended on June 28, 1967 and resumed on November 1, 1967 at Hamilton's request. On November 19, 1967, the transmittal of all performance and pressure data in final reduced form was completed. This report presents an explanatory text, detailed tabulations of the performance and pressure data, and a complete graphical presentation of the performance data.

This project was undertaken for Hamilton Standard under Purchase Order WPI IF1 BCO-104A dated March 7, 1966 and Purchase Order 46746 dated January 12, 1967.

INTRODUCTION

Interest in shrouded propeller studies has been stimulated by the advantages of ducted propellers over free-air propellers. The former is capable of producing the same thrust-to-power ratio as a free-air propeller of approximately twice its diameter (Ref. 1). Past shrouded propeller studies have been directed toward an optimum shroud configuration for overall performance throughout the propeller's anticipated operational speed regime. However, configurations designed for high thrust at low subsonic speeds require large bellmouth inlets as well as high exit-to-propeller area ratios which are undesirable for high subsonic speed flight because of their inherently high drag. A shroud designed for good high subsonic speed performance requires a sharp inlet lip and low exit-to-propeller area ratio which conversely produces poor low subsonic speed performance. As a consequence, this program was initiated to obtain data for shroud geometries applicable to both ends of the flight spectrum. These data supplement Hamilton's previous results obtained under Bureau of Naval Weapons, Contract NOw 64-0707-d. The subject data are applicable to a shroud capable of altering its shape to optimize performance (i.e., variable geometry shroud).

The subject shrouded propeller tests comprise the experimental phase of a program contracted by Hamilton Standard with the Naval Air Systems Command to provide systematically varied performance curves which are sufficient to permit empirical performance estimates for the pertinent flight conditions of a variable geometry shrouded propeller. The data obtained are presented herein in detailed tabular and graphical formats; the test apparatus and techniques are also described.

TEST FACILITY, PROPELLER DYNAMOMETER AND TEST MODELS

Wind Tunnel Facility

The UARL Large Subsonic Wind Tunnel, shown in Fig. 1, is a single-return closed-throat facility with interchangeable 18-ft and 8-ft octagonal test sections. Maximum tunnel velocity is approximately 200 mph in the 18-ft section and near sonic Mach numbers can be obtained in the 8-ft section. Tunnel stagnation pressure equals atmospheric pressure, and the stagnation temperature of the airstream was held constant in the 64 to 98 F range by means of air exchanger valves. Electric power may be supplied to test models

by two motor generator sets each of which develop a maximum of 375 hp at frequencies of 0 to 400 cps. Auxiliary vacuum systems and a 400 psig air supply are also available. A small digital computer and a static data acquisition system (capable of recording 200 steady pressures or temperatures) located in the tunnel control room are employed to record and process test data. A detailed description of the wind tunnel and its auxiliary equipment is given in Ref. 2.

Propeller Dynamometer and Shroud Balance

The model propellers were driven by the UARL propeller dynamometer, schematically illustrated in Fig. 2, which consists of two variable-speed motors, mounted in tandem and housed within a streamlined cast-steel pod with an integral support strut. The motors are mounted in hydrostatic bearings to restrain all motion except axial motion along or rotational motion about the longitudinal axis of the dynamometer. These motions were restrained by load cells which measure thrust and torque of the model propeller. Each motor is capable of delivering 375 hp at 12,000 rpm; together they provide a maximum torque of 330 lb-ft at any operational speed. Model speed was controlled by the variable frequency electrical power supplied by two motor-generator sets, and the model speed was measured with a Berkley EPUT meter and a 60-tooth gear signal generator. The dynamometer was faired to minimize the axial static pressure gradient in the plane of the propeller, Ref. 3. Additional data on airflow distortion and buoyancy effects produced by the dynamometer were obtained during the subject test program and are discussed in this report. The dynamometer is also designed so that the model propeller and hub are the only portion of the metric system exposed to the airstream. Pressure instrumentation was provided within the dynamometer in order to correct the measured thrust for any difference in pressure between the front face of the hub and an equal area in the rear fairing. Further details of the propeller dynamometer are presented in Ref. 3.

The shroud strain gage balance system, shown in Fig. 3, was used to support the shroud on the propeller dynamometer and to measure shroud-chord forces. The balance ground structure was provided by a new fairing of heavy gage rolled boiler plate machined to provide essentially the same shape as the metal fairing normally used. The shroud was supported on the ground structure by a three-point linkage schematically illustrated in Fig. 4. Support points P_1 and P_2, shown in Figs. 3 and 4, were fixed in the y-z plane (Fig. 4) by two "A" frames which were free to pivot at both ends. Points P_1 and P_2 were restrained in the axial direction by flexured load cells (C_4, C_5) which attached to the non-metric structure and which permitted lateral as well as vertical rotation, thus only axial chord forces (C_4, C_5) were transmitted through these points. Forces

N_1 and N_2 (not required for this test) could have been obtained directly from load cells which measure a bending moment in the lateral plane between points P_1 and P_2 and the shroud. Support point P_3 was fixed in space by a rigid support arm projecting forward from the fairing of the extension shaft housing. A flexured load cell (N_3) could have been inserted between the side arm and shroud and used to determine the side force on the latter, but the normal forces at zero degrees yaw were found to be negligibly small in Ref. 4 and the side force was therefore not determined during the subject test. The tare and interference effect of the "A" frames was obtained with the use of a dummy support system.

Propeller Dynamometer and Shroud Installation

The shroud-dynamometer was installed in each test section at a yaw angle of zero degrees and with the thrust axis coincident with the tunnel centerline elevation. Figures 5 and 6 illustrate the model installation in both the 8- and 18-ft sections, respectively. Dynamometer monitoring instrumentation consisted of an EPUT meter for rotational speed, a vibration meter with provision for selecting vertical or horizontal motion and a Speed-O-Max display for numerous thermocouple temperatures. Pressure leads from the dynamometer and electrical leads from the dynamometer and shroud balance were connected at the dynamometer strut bulkhead then led across the tunnel balance chamber to the appropriate facility in the control room. Pressure tubing leads from the shroud and exit rakes were led downstream across the shroud balance linkage, along and down the leading edge of the dynamometer, and into the balance chamber where they were connected to a patch panel. Pressure tubing leads from the inlet rakes and spinner (P_1 in Fig. 2) were led upstream through the spinner and a sting, through the sting support struts, and into the balance chamber where they were connected to the patch panel. At the patch panel the leads were directed to the static data acquisition system and manometer boards in the tunnel control room. The electrical and pressure leads from the traversing probe were led into the balance chamber and then directed to the appropriate facility in the control room.

Test Models

The test models consisted of two high-speed, 20-in. chord shrouds, one low-speed, 23-in. chord shroud and two sets of propeller blades. Each shroud configuration was fabricated from a solid aluminum ring with circumferential grooves for the implacement of pressure instrumentation. These grooves were

then filled with plastic filler and blended to match the local contours. Figure 7 shows two shroud models and identifies some of the model components, all of which are specified in detail in Appendix I.

The test models included two sets of propeller blades, illustrated in Fig. 8, comprising wide and narrow tip planform three-way configurations previously used during Ref. 4 testing. The geometry of each blade is described in Appendix I, Figs. I-5 and I-6. The blades were aluminum although the wide tip set incorporated fiberglass tips which during a previous test (Ref. 4) provided for tip clearance variations between the blade tip and shroud. The blades installed in the 7.5-in. diameter steel hub provided a disc diameter of approximately 30 in. Both propellers had an activity factor of 168 and a design camber of 0.4. Changes in blade angle were accomplished by manually turning worm gears in the hub that mesh with integral gear sectors on the blade root.

Provisions for the mounting of inlet pitot-static rakes and an exit total pressure rake were provided in addition to the static pressure orifices incorporated in the model shroud components. The 15-orifice, pitot-static inlet rake and the 25-orifice total pressure exit rake were nonmetrically supported from the spinner and dynamometer cowl fairing, respectively. A probe which traversed the exit of each shroud was mounted from the tunnel floor. A complete description of this instrumentation is provided in Appendix II.

The configuration designation system used herein is a continuation of that used in Ref. 4 and is based on 16 symbols, each consisting of a letter with subscripts denoting variables. A typical sample would be $L_4C_1E_7B_3P_{WT}T_1$, which defines the complete shroud-propeller model with inlet lip four (L_4), propeller at 40-percent shroud chord (C_1), diffuser exit area ratio of 1.0 (E_7), three-way hub (B_3), wide-tip planform blade (P_{WT}) and basic blade tip-shroud clearance (T_1). The symbols are concisely defined in Appendix I and illustrated in Figs. 7 and 8. Special forms of these symbols used in computer tabulations are included in parenthesis after the symbol definition in Appendix I.

TEST PROCEDURES

Initial Testing

Initial testing consisted of traversing probe calibration, tunnel blockage calibration, dynamometer buoyancy investigation, hub tare, and "A"-frame tare and interference runs. The traversing probe calibration, as described in Appendix II, defined the parameters required for interpretation of velocity-angularity data. The blockage calibrations, as described in Appendix III, provided a technique for setting tunnel speed. The buoyancy investigation, as described in Appendix IV, defined the local airflow distortion that occurred at the shroud inlet and exit stations due to the dynamometer presence as well as the resultant buoyancy drag effects for shroud chord force corrections. The hub tare runs, as described in Appendix V, defined the hub skin friction effects for thrust measurement corrections.

The tare and interference runs, as described in Appendix VI, defined the effects of the "A" frame which were to be deleted from the shroud chord force data. Based on stress data observed during the previous shrouded propeller test (Ref. 4), a safe operating range (windmill rpm to 8000 rpm) was established for the blades used. Propeller dynamic balance calibrations were interspersed in the test program and were conducted following assembly and static balancing of each hub propeller configuration. These calibrations consisted of monitoring horizontal and vertical vibration as sensed by the vibration gages immediately downstream of the hub as shown in Fig. 2. A safe operating limit of ±0.005 in. has been established for the subject test rig.

Performance Testing

The performance test program consisted of recording and processing propeller thrust and torque, shroud chord force and shroud inlet and exit pressures for various model blade angles through a range of rotational speed at constant Mach number, shroud configuration and zero yaw angle. Each rotational speed setting constituted a test point and each range of rotational speed defined a data run.

The performance data instrumentation consisted of one EPUT meter for propeller rotational speed and seven strain gage unit potentiometers for torque, thrust, delta thrust, chord force (two load cells), and local Mach

number at the hub (two transducers). This instrumentation incorporated a locking circuit which provided a simultaneous visual sample of each signal which was manually recorded and at the same time punched into a digital computer in the tunnel control room for processing. The almost simultaneous reduction of the basic data permitted a manual on-line graphic presentation of the data in coefficient form. The inlet and exit pressure data were displayed on manometer boards in the control room and recorded both photographically and on paper tape with the static data acquisition system. The latter data were reduced upon completion of the test program at the UARL Computation Laboratory.

Performance data in the Mach number ranges from 0.02 to 0.20 and 0.2 to 0.6 were obtained in the 18-ft and 8-ft test sections, respectively. A functional sequence of shroud configurations with attendant run numbers and figure numbers is presented in Table I, and a detailed listing of each run obtained during the entire program is given in Table II.

Pressure Testing

The pressure program consisted of recording and processing pressures sensed by a probe traversed radially across the shroud exit area for various model blade angles, rotational speeds, Mach numbers, and shroud configurations. Each radial station setting constituted a test point and each complete traverse across the shroud exit area at constant (design) rotational speed, plus that data generated at a specified rotational speed above and below the design rpm for one radial position of the traversing probe, defined a pressure run. In addition to the traverse probe data, pressures sensed with the inlet pitot-static rake, the exit total pressure rake and the static orifices on the shroud were recorded on paper tape and processed at the Computation Laboratory.

DATA REDUCTION AND STATEMENT OF ACCURACY

The reduction of the performance and pressure data which were obtained during the runs listed in Table I is discussed herein. Additional calibration and tare data are described in Appendices II through VI. The data reduction equations for the performance data are presented in Appendix VII in the initial five sections. The first section (Eqs. 1 to 4) is preliminary in nature and includes standard calculations for determining tunnel air density and velocity based on the nominal test section Mach number and an equation for solid and wake blockage corrections to tunnel velocity. The symbols used in these equations and all subsequently discussed equations are defined in the List of

Symbols. The second group of equations (Eqs. 5 to 7) converts the force and moment gage readings to thrust, torque and chord force. The third and fourth groups of equations (Eqs. 8 to 12) indicate expressions for tare and interference corrections and balance interactions to the basic force and moment equations. The fifth group of equations (Eqs. 13 to 22) converts thrust, torque and chord force to aerodynamic coefficient form and also includes standard calculations for advance ratio, efficiency, shaft horsepower and propeller tip speed. These equations also indicate the "A"-frame tare and interference correction on chord force. The parameters defined by Eqs. 13 to 22 represent the required performance data in their final algebraic form.

The data reduction equations for the pressure data are presented in the remaining three sections. Section VI (Eqs. 23 to 29) presents the equations used to determine the actual free-stream values of dynamic pressure, Mach number, static pressure and velocity, and application of these to the pressure coefficient calculation. The propeller thrust effect correction used in performance parameter data reduction Eq. 4 was not applied to dynamic pressure (Eq. 25) nor the other flow parameters used in pressure coefficient data reduction for convenience and consistency with Ref. 4. Section VII (Eqs. 30 and 31) presents the equations used in calculating the inlet velocities. The final group of equations (Eqs. 32 to 37) includes expressions for converting traversing probe pressures to the inclined velocity and to a projected velocity component parallel to the thrust axis.

At the conclusion of the test program a statistical analysis based on methods outlined in Ref. 5 was made of approximately 75 static zero shifts noted for each of the three balance components. Estimates of static data accuracy (two standard deviations) based on these results are tabulated below.

Component	System Capacity	Measured Force or Moment		Coefficient (5000 RPM)	
		Current Test	Ref. 4	Current Test	Ref. 4
Thrust, lb	700	±0.34	±0.93	±0.0006	±0.002
Torque, ft-lb	500	±0.25	±0.54	±0.0011	±0.002
Chord Force, lb	±1000	±0.92	±1.26	±0.0016	±0.004

The above coefficients are based on air density equals 0.0022 slugs/cu ft and propeller diameter equals 2.495 ft.

Accuracy in setting propeller rotational speed and propeller blade angle is estimated as ±1 rpm and ±0.1 deg, respectively. Accuracy in setting tunnel Mach number is estimated as ±0.005 in the 18-ft tunnel and ±0.021 in the 8-ft section.

Overall data repeatability as influenced by all of these parameters and also by model configuration duplication is illustrated in Figs. 9 to 14 of the Data Repeatability tab section. Figures 9 and 10 present data repeatability in the speed regime of the 18-ft tunnel; Figs. 11 to 14 present data repeatability in the 8-ft test section. The plots presented are of the repeat runs conducted intermittently throughout the test program and are felt to be representative of the overall data repeatability.

An arithmetic mean estimate of the pressure data repeatability based on a small number of samples indicated values of±0.06 in surface pressure coefficient, ±1.0 fps in inlet velocity, ±0.01 psi in exit total pressure, ±0.5 deg in traverse probe yaw angle (ZETA), ±1.0 deg in traverse probe pitch angle (THETA), and ±5 fps in traverse probe velocity (V'). The accuracy in setting the traversing probe radial position was estimated as 0.012 in.

PRESENTATION OF DATA

The presentation of the performance data is in the form of aerodynamic coefficient plots and tabulations. The plots are divided into three tab-sectioned groups descriptively annotated as: Data Repeatability, Low Speed Shroud Effects and High Speed Shroud Effects. The first tab section presents a comparison of the data repeatability as discussed in the preceding section of this report (Data Reduction and Statement of Accuracy). All performance data are presented so that the effects of a specific change in model geometry is illustrated. Within each tab-sectioned group the salient aerodynamic parameters for low (M = 0.02 to 0.10) and high (M = 0.20 to 0.60) speed performance are presented in sets of two and three figures. The low-speed performance plots present power coefficient, thrust coefficient, net thrust coefficient and chord force versus advance ratio. The high-speed performance plots present efficiency, net efficiency and power coefficient with cross plots of constant efficiencies overlayed versus advance ratio. In addition to the graphic presentation of the performance data, a complete tabulation of these data is presented in Table III.

The efficiencies presented in the high-speed performance data are noted to be in excess of 100 percent and the efficiencies in the low-speed performance data are noted to be irregularly low, ranging from 10 to 50 percent. It is felt that this is an effect of the definition of efficiency as presented in Appendix VII and used in the data reduction. As presented herein, efficiency is based on free-stream velocity as an approximation of the velocity field felt by the shroud and propeller. This was done to be consistent with the previous results presented in Ref. 4 to aid in overall comparisons and because of the difficulty in defining the correct propeller velocity.

Concurrent with the acquisition of performance data and in addition to the pressure data obtained during the pressure data phase of the test program, the shroud inlet velocity and shroud exit total pressure data were obtained. Complete tabulations of these data have been transmitted to HS personnel and only selections (at a propeller speed of 6000 rpm) of these results are presented in Table IV in the form of data tabulations. The shroud inlet velocity data generated during the "A"-frame tare and interference phase of testing are presented in Table V.

The presentation of the remainder of pressure data obtained during the pressure data phase of the test program is also in the form of data tabulations. Table VI is a complete tabulation of the traversing probe data acquired and Table VII is a representative tabulation of shroud surface pressure coefficients, inlet velocities and exit total pressures simultaneously acquired with the traversing probe data at a single probe radial position for each propeller rotational speed. The identification system for identifying the tabulated pressure coefficients presented in Table VII is presented in Appendix I.

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8. Black, D.: Tare and Interference (T&I) for the Shroud "A"-Frame Support System for the 8-Foot Tunnel Testing. Memorandum to A. Simmonds, June 24, 1966.

LIST OF SYMBOLS

A	Ordinate intercept of hub skin friction tare equation, lb, Ref. Appendix V
A_e	Area of the shroud exit, station 100% chord, sq ft
A_P	Disc area of 2.494 ft diameter propeller (T_1), sq ft
A_T	Cross-sectional area of test section; 49 sq ft for 8-ft test section, 268 sq ft for 18-ft test section
A_X	Shroud total included frontal area, $\pi(R + t_{max})^2$; 5.768 cu ft for 8-ft test section, 7.426 cu ft for 18-ft test section
B	Slope of hub skin friction tare versus local Mach number, lb/M_ℓ, Ref. Appendix V
b	Blade local chord, ft
C	Shroud chord force, lb
C_c	Shroud chord force coefficient, positive upstream (CC)
C_{c_t}	"A"-frame chord force tare coefficient, Ref. Appendices VI, VII
C_L	Integrated design lift coefficient
C_{L_D}	Blade design lift coefficient
C_P	Power or pressure coefficient, (CP)
C_T	Thrust coefficient, (CT)
$C_{T_{NET}}$	Net thrust coeffic ient, (CT NET)
C_4	Shroud chord force measured at point P_1, (Fig. 4)
C_5	Shroud chord force measured at point P_2, (Fig. 4)
c	Shroud chord length, in.

LIST OF SYMBOLS
(Contd.)

D	Traversing probe orifice distance from propeller axis, in.
D_B	Buoyancy drag due to pressure gradient along tunnel axis, lb, Ref. Appendices IV, VII
d	Traversing probe orifice height off tunnel flcor during calibration
d_p	Actual model propeller diameter, ft, Ref. Appendix I
d_s	Shroud internal diameter at propeller plane, 30.0 in.
$\bar{d}$	Average diameter to shroud camber line
e	"A"-frame drag parameter, Ref. Appendices IV, VII, positive downstream
f	Correction term in "A"-frame tare equation, Ref. Appendices VI, VII, 2.71e
f_{h_t}	Hub skin friction tare on thrust, lb, Ref. Appendix V, positive downstream
g	Acceleration due to gravity, 32.16 ft/sec/sec
H	Barometric pressure, psf, (H)
HP	Horsepower, (HP)
h	Blade local thickness, ft
J	Advance ratio
K	Slope of ΔT_R, sgu/psf
$\bar{K}$	Constant for determining static pressure at traversing probe; obtained from probe calibration data, Ref. Appendix II
K_1	Slope of torque strain gage unit (sgu) readout instrument, 0.049843 ft-lb/sgu

LIST OF SYMBOLS
(Contd.)

K_2	Slope of thrust (sgu) readout instrument, 0.073047 lb/sgu
K_3	Slope of ΔT (sgu) readout instrument, 0.008812 lb/sgu
K_7	Slope of chord force, C_4 (upper "A"-frame load cell), readout instrument, 0.043222 lb/sgu
K_8	Slope of chord force, C_5 (lower "A"-frame load cell), readout instrument, 0.044113 lb/sgu
K_9	Slope of local (hub), total pressure readout instrument, 0.035457 psf/sgu
K_{10}	Slope of local (hub), static pressure readout instrument, 0.071247 psf/sgu
LER	Leading edge radius, % chord
M	Nominal Mach number, uncorrected for blockage (performance data), (M)
M_ℓ	Mach number at 20-deg azimuth approximately 1.5 in. above hub surface, Ref. Appendix V
M_r	Mach number pressure ratio at traversing probe, Ref. Appendix II
M_{SB}	Mach number at upstream speed orifice
M_{TP}	Mach number at traversing probe, Ref. Appendix VII
M_u	Clear test section Mach number
M_∞	Mach number at propeller plane corrected for shroud total blockage only, (MINF)
N	Rotational speed, rpm, (N)
N_1	Shroud normal forces measured at point P_1, (Fig. 4)

LIST OF SYMBOLS
(Contd.)

N_2	Shroud normal forces measured at point P_2, (Fig. 4)
N_3	Shroud normal forces measured at point P_3, (Fig. 4)
n	Rotational speed, rps
P	Pressure, psf or power, ft-lb/sec
P_{SB}	Pressure at upstream speed orifice, psf
PTR	Propeller test rig
P_{1-4}	Dynamometer pressures, Ref. Fig. 2, psf or load points, Ref. Fig. 4
Δp_t	Hub pressure differential tare (buoyancy) on thrust, lb
Q	Torque, ft-lb
Q_P	Torque uncorrected for thrust interaction on torque, ft-lb
q	Dynamic pressure corrected for shroud total and propeller wake blockage (performance data); or, corrected for shroud blockage only (pressure data), psf, (Q)
q_t	Interaction slope of torque on thrust, 0 lb T/ft-lb Q_P
q_u	Dynamic pressure uncorrected for blockage, psf
R	Gas constant, 1722 $ft^2/sec^2\ ^oR$; nominal blade radius, 15 in.
r	Local propeller radius, in.
S_i	Shroud cross-sectional area for sector i
T	Thrust, lb
TER	Trailing edge radius, % chord
T_{NET}	Net thrust (T+C), lb

LIST OF SYMBOLS
(Contd.)

T_P	Thrust uncorrected for hub pressure differential tare, hub skin friction tare and balance interactions, lb
TS	Test section
T_{SC}	Settling chamber temperature, ^{o}R, (TSC)
T_{TP}	Temperature at traversing probe
ΔT	Increment of thrust due to axial pressure differential across hub, lb
t	Shroud or blade thickness, in.
t_q	Interaction slope of thrust on torque, 0 ft-lb Q/lb T_P
V	Velocity
V_o	Velocity of airstream corrected for shroud solid and wake blockage and propeller wake blockage, fps, (VO)
V_T	Propeller tip speed, fps, (VT)
V_{TP}	Velocity measured at traversing probe, fps, (VTP)
V_u	Velocity of airstream uncorrected for blockage, fps
V'	Velocity component parallel to thrust axis at traversing probe, fps, (VPR)
V_∞	Velocity corrected for shroud blockage, (VINF)
β	Blade twist, deg, Ref. Appendix I
γ	Ratio of specific heat of air, 1.4
$\left(\frac{\Delta p}{\Delta x}\right)_i$	Axial pressure gradient in shroud sector i
ϵ_s	Shroud solid and wake blockage correction, 0.0294 for the 8-ft test section; 0.00693 for the 18-ft test section, Ref. Appendix VII

LIST OF SYMBOLS
(Contd.)

Z	Angle of yaw at traversing probe, deg, (ZETA)
η	Propeller efficiency, (ETA)
η_{NET}	Net propeller efficiency, (ETA NET)
θ	Blade angle at 3/4 blade radius, (THETA 3/4); or pitch angle at traversing probe, (THETA), deg, Ref. Appendix II
θ_r	Ratio of pressure differential across axial static orifices to traverse orifices on traversing probe, Ref. Appendix II
π	Constant, 3.1416
ρ	Mass density of free airstream, slugs/cu ft, (RHO)
ψ	Angle of yaw, deg, (PSI)

Subscripts

AVE	Average value across shroud inlet station, (AVE)
i	Conditions at inlet static orifices 1, 3, 4, 6, 7, 9, 10, 12, 13, 15, (Fig. II-2) or axial division of shroud stations for evaluation of buoyancy drag
j	Inlet total orifices 2, 5, 8, 11, 14 used with static i = j±1 (Fig. II-2)
ℓ	Local condition, 1.5 in. above hub surface
m	Model surface
o	Initial or zero gage reading or ambient condition
P	Parameters uncorrected for interactions, buoyancy and tares
R	Strain gage reading, sgu

LIST OF SYMBOLS
(Contd.)

Subscripts (Contd.)

s	Static pressure
t	Total pressure
u	Uncorrected for blockage
∞	Free-stream conditions, corrected for solid blockage, (INF)
1-5	Orifices on traversing probe, (see Fig. II-4)

APPENDIX I

HS VG SHROUDED PROPELLER TEST

Model Component Identification and Dimensional Data

This appendix presents a listing of the model component symbols, surface pressure orifice identification and associated dimensional data.

		Fig.
I - Model Component Designation Symbols		
A_D	Chord force "A"-frame dummy, (AD)	VI-1
B_X	Propeller hub configuration	7
	where subscript X = 3, 3-way hub, (B3) X = 4, 4-way hub, (B4)	
C_1	Propeller plane located at 40% shroud chord, (C1)	I-1 - I-3
E_X	Diffuser section	7, I-1 - I-3
	where subscript X = 6, shroud exit area divided by shroud internal area at propeller equal 0.9, (E6)	
	X = 7, shroud exit area divided by shroud internal area at propeller equal 1.0, (E7)	
	X = 8, shroud exit area divided by shroud internal area at propeller equal 1.4, (E8)	
L_X	Inlet lip	7, I-1 - I-3
	where subscript X = 4, high speed lip, (L4) X = 5, low speed lip, (L5)	

APPENDIX I
(Contd.)

		Fig.
I - Model Component Designation Symbols - (Contd.)		
P_{XX}	Planform of propeller blades	I-5 - I-6
	where subscript XX = WT, wide tip planform, (PWT) XX = NT, narrow tip planform, (PNT)	
PTR	Propeller dynamometer, (PTR)	2, 3
R_1	Inlet pitot-static velocity rake at 20-deg azimuth, (R1)	7, II-1 - II-2
R_E	Exit total pressure rake at 75-deg azimuth, (RE)	7, II-1 - II-3
R_{E_5}	Exit pitot-static velocity rake at 130-deg azimuth, (RE5)	II-1 - II-2
R_{G_X}	Buoyancy (pressure gradient) rake	IV-1 - IV-2
	where subscript X = 1, 20-deg azimuth, (RG1) X = 5, 130-deg azimuth, (RG5)	
T_P	Traversing probe at 166.5 deg azimuth and at trailing edge of shroud diffuser (tunnel station, 71.75 in. for the 18-ft section; 69.96 in. for the 8-ft section), (TP)	7, II-1 - II-4
T_{P4}	Traversing probe protruding from tunnel floor at tunnel station -32 in., (TP4)	
T_X	Blade tip-shroud clearance	
	where subscript X = 1, 29.925 in. diameter propeller, (T1) X = 2, 29.850 in. diameter propeller, (T2)	
	NOTE: Minimum internal shroud diameter = 30.0 in. for all shrouds.	

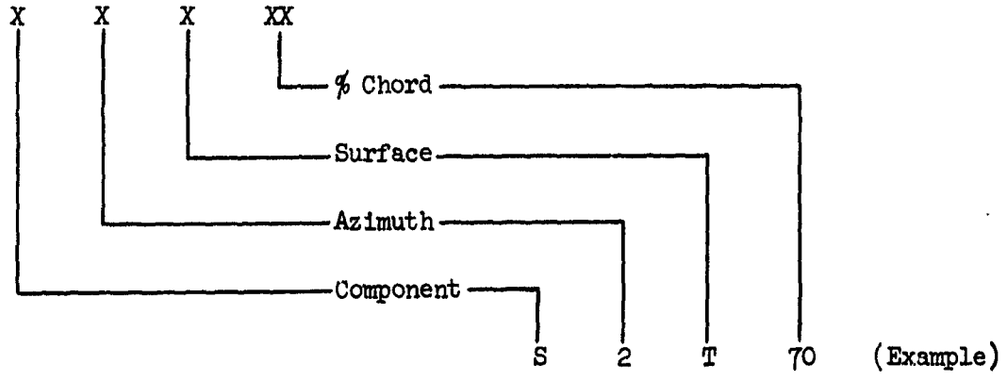
APPENDIX I
(Contd.)

II - Surface Pressure Orifice Identification System for Table VII

A. Symbols

S	- Shroud	1	- 45 deg azimuth
B	- Inside Surface	2	- 135 deg azimuth
LEO	- Leading Edge		
T	- Outside		

B. Orifice Legend



APPENDIX I
(Contd.)

III - Model Dimensional Data

Title and Description	Fig.
Shroud $L_4C_1E_6$ Ordinates	I-1
Shroud $L_4C_1E_7$ Ordinates	I-2
Shroud $L_5C_1E_8$ Ordinates	I-3
Spinner Ordinates	I-4
3-Way Wide Tip Blade Geometry	I-5
3-Way Narrow Tip Blade Geometry	I-6

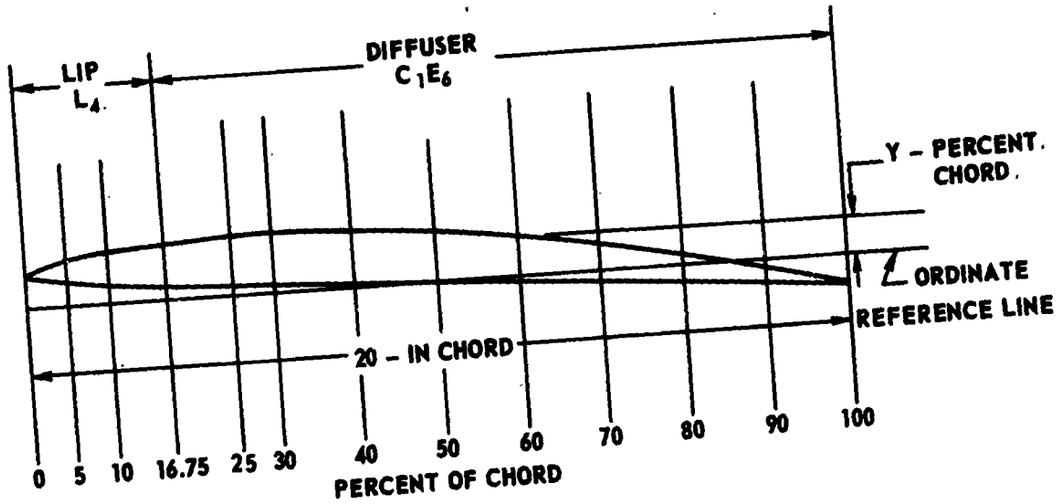
F331012-1

HS VG SHROUDED PROPELLER TEST

MODEL DIMENSIONAL DATA

SHROUD $L_4C_1E_6$ ORDINATES

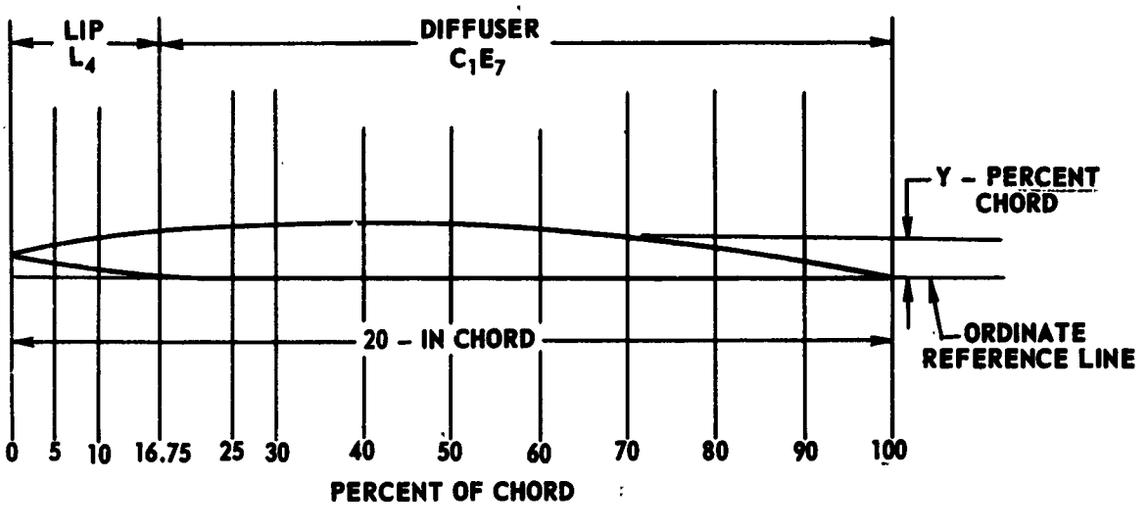
AREA RATIO = 0.9



STATION PERCENT CHORD	ORDINATE Y	
	UPPER	LOWER
0.00	3.440	3.440
0.50	3.910	2.990
1.25	4.200	2.750
2.50	4.460	2.560
3.75	4.700	2.415
5.00	4.900	2.275
7.50	5.225	2.035
10.00	5.500	1.860
15.00	5.900	1.480
20.00	6.160	1.125
25.00	6.300	0.760
30.00	6.290	0.395
35.00	6.175	0.100
40.00	6.000	0.000
45.00	5.730	-0.100
50.00	5.370	-0.250
60.00	4.310	-0.740
70.00	2.760	-1.305
80.00	0.890	-1.925
90.00	-1.090	-2.565
100.00	-3.375	-3.375
* L.E.R. = 0.24%	t/c = 6%	

* L.E.R. = LEADING EDGE RADIUS

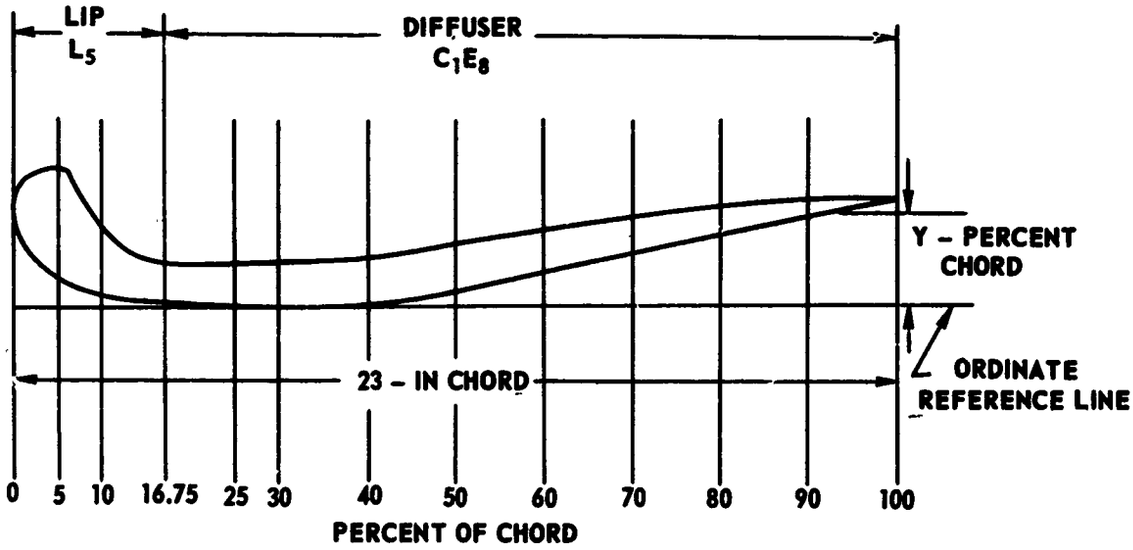
HS VG SHROUDED PROPELLER TEST
MODEL DIMENSIONAL DATA
SHROUD $L_4C_1E_7$ ORDINATES
AREA RATIO = 1.0



STATION PERCENT CHORD	ORDINATE Y	
	UPPER	LOWER
0.00	2.325	2.325
0.50	2.710	1.860
1.25	2.890	1.640
2.50	3.290	1.460
5.00	3.750	1.315
7.50	4.085	1.190
10.00	4.375	0.990
15.00	4.875	0.840
20.00	5.265	0.600
25.00	5.565	0.400
30.00	5.780	0.225
35.00	5.910	0.115
40.00	6.00	0.000
45.00	6.00	0.000
50.00	5.860	0.000
60.00	5.275	0.000
70.00	4.790	0.002
80.00	3.030	0.050
90.00	1.660	0.065
100.00	0.100	0.100
* L.E.R. = 0.24%	t/c = 6%	

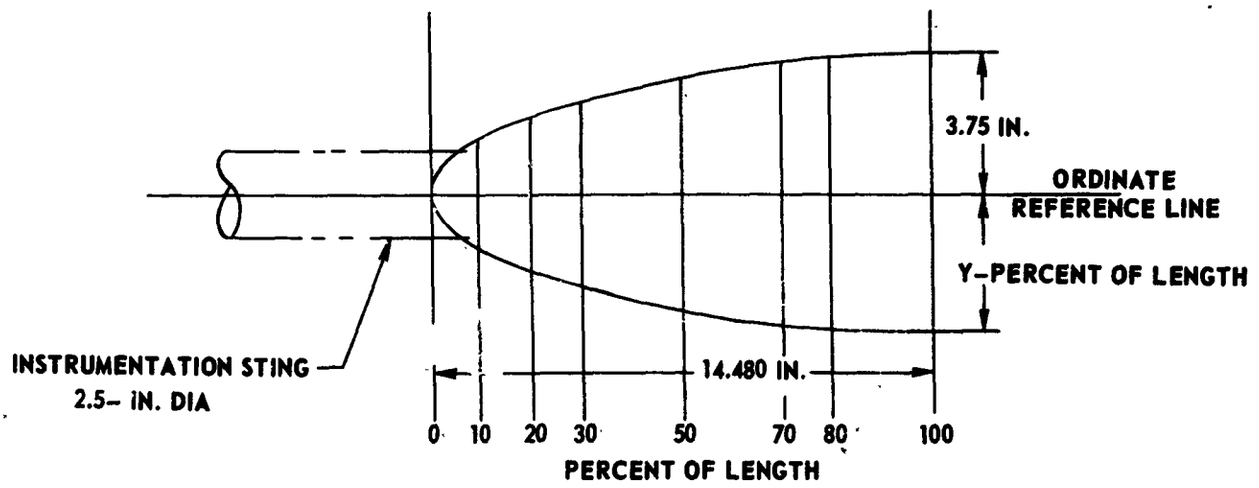
* L.E.R. = LEADING EDGE RADIUS

HS VG SHROUDED PROPELLER TEST
MODEL DIMENSIONAL DATA
SHROUD $L_5C_1E_8$ ORDINATES
AREA RATIO = 1.4



STATION PERCENT CHORD	ORDINATE Y		STATION PERCENT CHORD	ORDINATE Y	
	UPPER	LOWER		UPPER	LOWER
0.00	10.868	10.868			
0.22	12.172	9.303	30.40	5.151	0.052
0.44	12.606	8.564	34.80	5.216	0.000
0.65	12.954	8.020	39.30	5.216	0.000
0.87	13.215	7.607	40.30	5.303	0.078
1.30	13.650	6.868	41.40	5.434	0.183
1.74	13.976	6.260	42.60	5.651	0.313
2.17	14.215	5.738	43.60	5.825	0.469
2.61	14.476	5.216	47.80	6.521	1.269
3.48	14.867	4.347	52.10	7.216	2.108
4.36	14.997	3.630	56.50	7.912	2.965
5.21	14.932	3.021	60.80	8.520	3.825
6.08	14.454	2.521	65.20	9.129	4.677
6.95	12.954	2.087	69.50	9.694	5.521
8.70	9.998	1.413	73.90	10.172	6.381
11.30	7.173	0.782	78.20	10.433	7.229
13.90	5.564	0.543	82.60	10.781	8.085
15.65	4.990	0.435	87.00	11.085	8.933
17.40	4.716	0.356	91.30	11.346	9.781
21.70	4.869	0.226	95.60	11.520	10.641
26.10	5.043	0.122	100.00	11.520	11.520

HS VG SHROUDED PROPELLER TEST
MODEL DIMENSIONAL DATA
SPINNER ORDINATES



STATION PERCENT OF LENGTH	SPINNER ORDINATE, Y UPPER AND LOWER
0	0.0
1	2.69
2	3.81
3	4.74
4	5.56
5	6.31
10	9.36
15	11.73
20	13.65
25	15.32
30	16.81
35	18.15
40	19.36
45	20.45
50	21.42
60	23.08
70	24.33
80	25.21
90	25.74
100	25.90

FIG. 1 – 5

HS VG SHROUDED PROPELLER TEST
MODEL DIMENSIONAL DATA
3– WAY WIDE TIP BLADE GEOMETRY
SK 57144
DESIGN $C_L = 0.4$

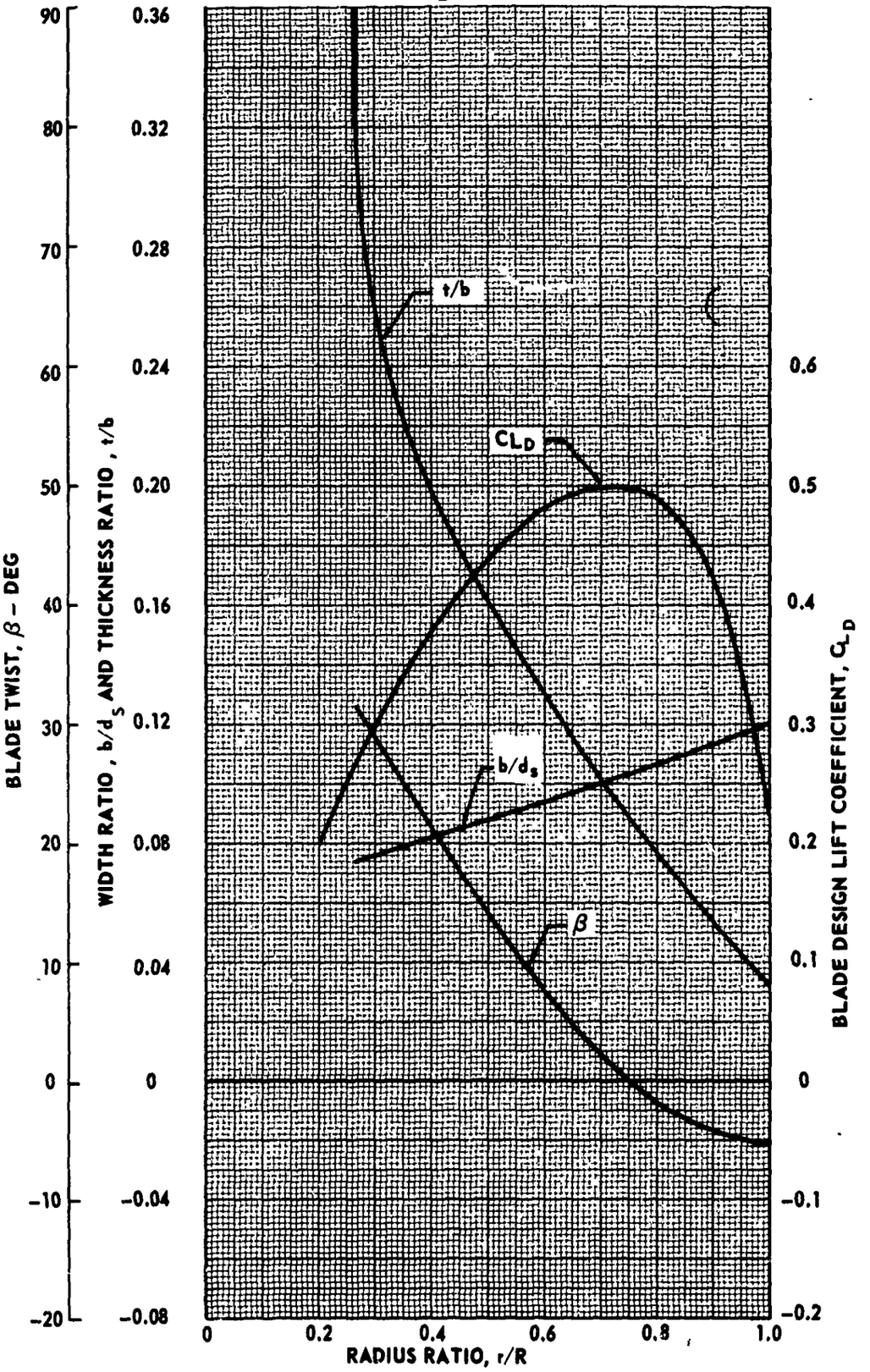
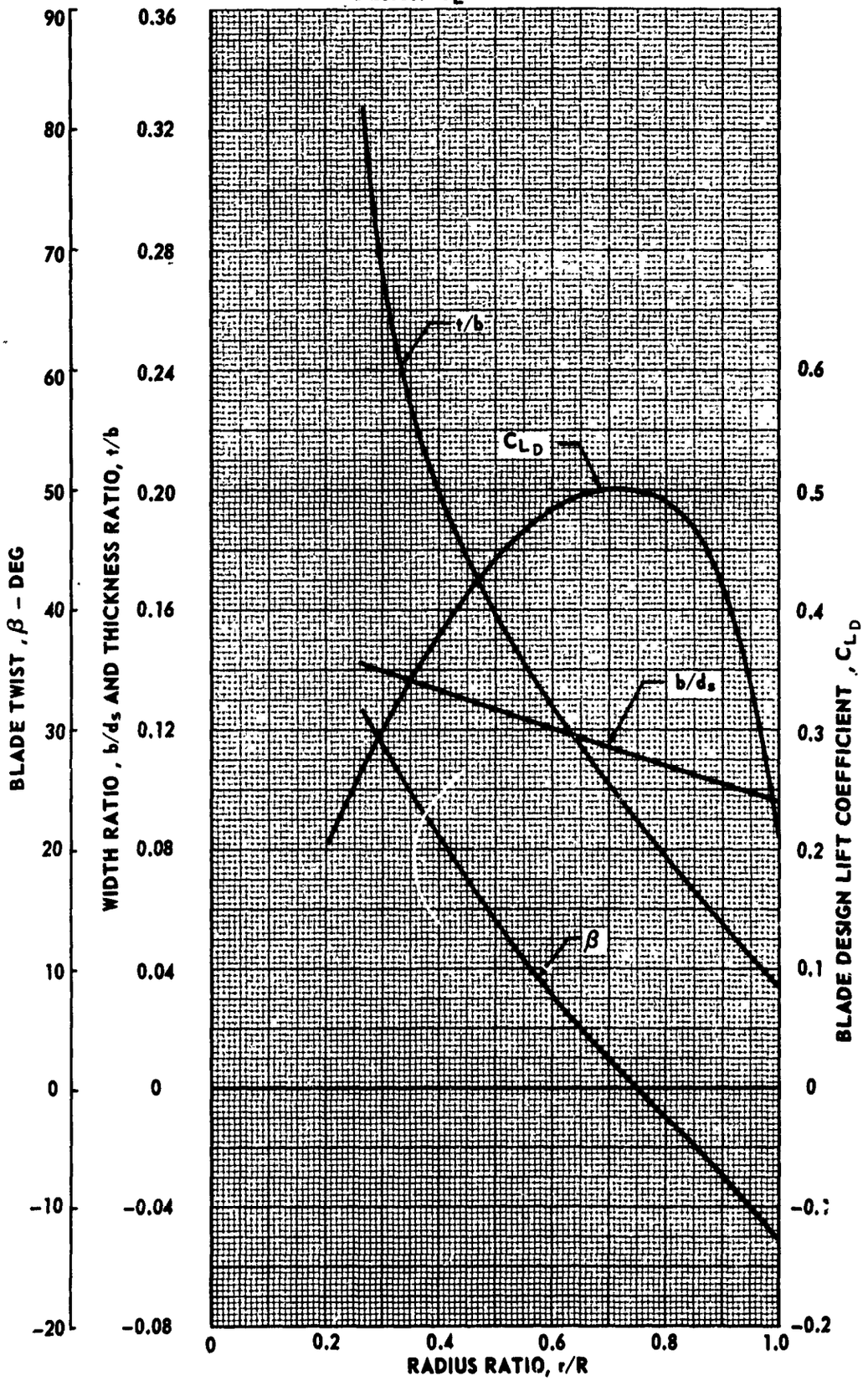


FIG. I-6

HS VG SHROUDED PROPELLER TEST
MODEL DIMENSIONAL DATA
3 – WAY NARROW TIP BLADE GEOMETRY
SK 57145
DESIGN $C_L = 0.4$



APPENDIX II

HS VG SHROUDED PROPELLER TEST

Pressure Sensing Instrumentation and Traversing Probe Calibration

This appendix describes the pressure sensing instrumentation used during the subject test. As shown in Fig. II-1, the instrumentation consisted of a pitot-static rake located at the shroud inlet station, an exit total pressure rake, shroud surface static pressure orifices at two azimuth angles, and a traversing probe. Pressures sensed by these devices were converted to electrical signals with transducers and recorded on paper tape with the static data acquisition system located in the tunnel control room. In addition to the paper tape record, a photographic record of the pressures as displayed on manometer boards was obtained. Sketches of the inlet pitot-static rake, the exit total pressure and pitot-static rakes and the traversing probe are presented in Figs. II-2, II-3, and II-4. Figures II-5 and II-6 present the results of the traversing probe calibration conducted immediately after the 8-ft section test and used in the final reduction of traversing probe data obtained in the 8- and 18-ft test sections.

The traversing probe calibration was performed to extend the scope of the existing calibration into the region of more negative pitch angles. The calibration data generally conformed with the anticipated results based upon the previous UARL calibration as reported in Ref. 4. The repeatability of overlapping calibration points between the two UARL calibrations reaffirmed the mutual UARL-HS decision to employ the UARL generated calibration data, and renewed confidence in the probe's reliability. The calibration data were used in conjunction with Eqs. 30 through 37 of Appendix VII to define the velocity and angularity of the airflow at the probe station.

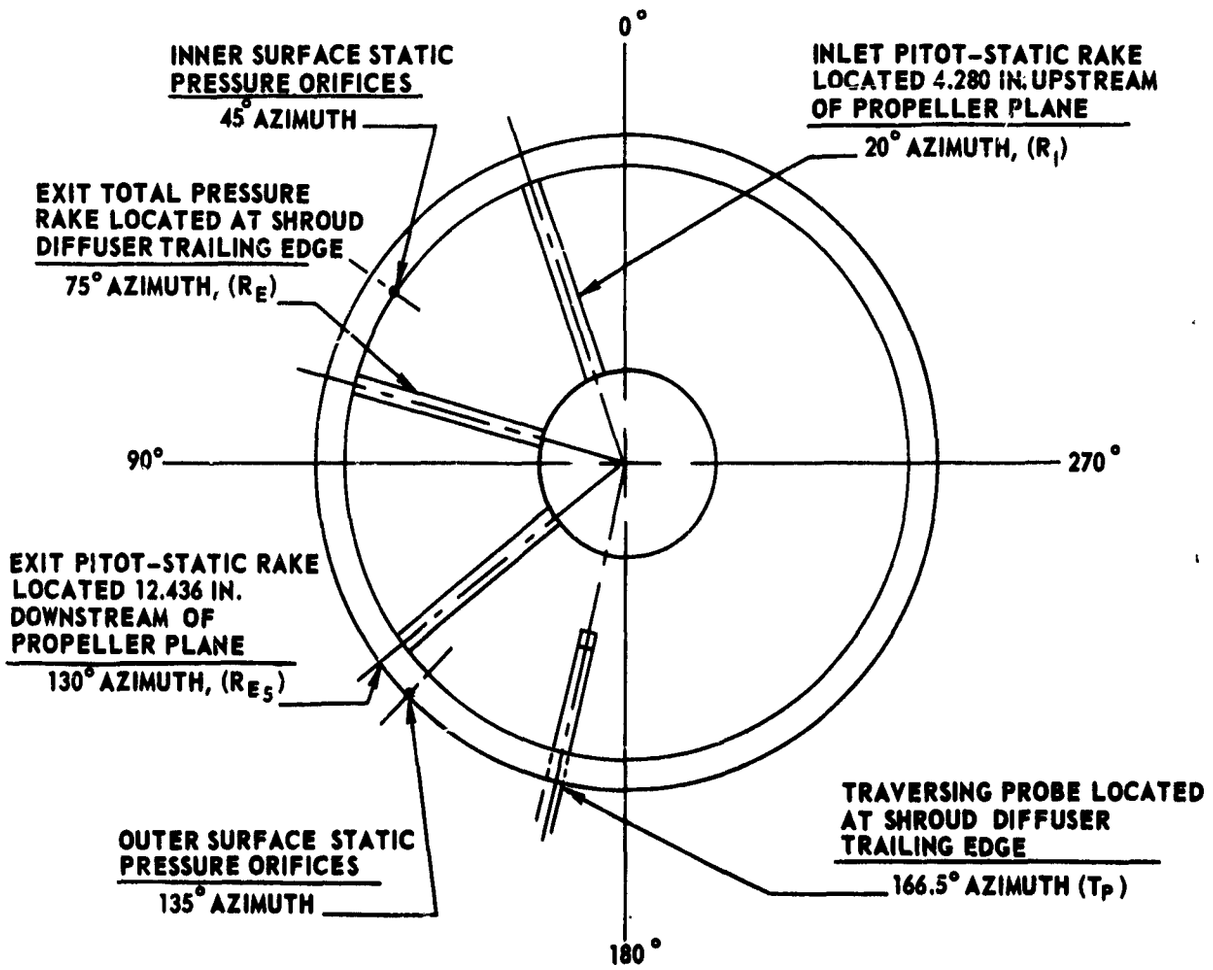
The test technique employed with the traversing probe consisted of recording pressures P_1 through P_5 at discrete radial stations at the shroud exit plane and a shroud azimuth of 166.5 deg. Radial positioning of the probe was remotely controlled at a console in the tunnel control room which also provided for rotating the probe to balance the pressures P_2 and P_3 shown in Fig. II-4. Nulling of these pressures provided a yaw angle (ZETA) in numerical display through an electro-mechanical system integral in the control console. With a discrete radial position and yaw angle the parameters M_r and θ_r were determined by Eqs. 32 and 33 of Appendix VII, respectively. With values M_r

APPENDIX II
(Contd.)

and θ_r, pitch angle (THETA) and subsequently parameter $\bar{K}$ were determined from the calibration data presented in Figs. II-5 and II-6, respectively. Linear interpolation was used to determine pitch angle and $\bar{K}$ for values of M_r and θ_r parameter intermediate to the presented curves. The parameter $\bar{K}$ was used to determine a corrected static pressure (Eq. 34) which in turn leads to the determination of Mach number, velocity and the axial component of velocity by Eqs. 35 through 37, respectively.

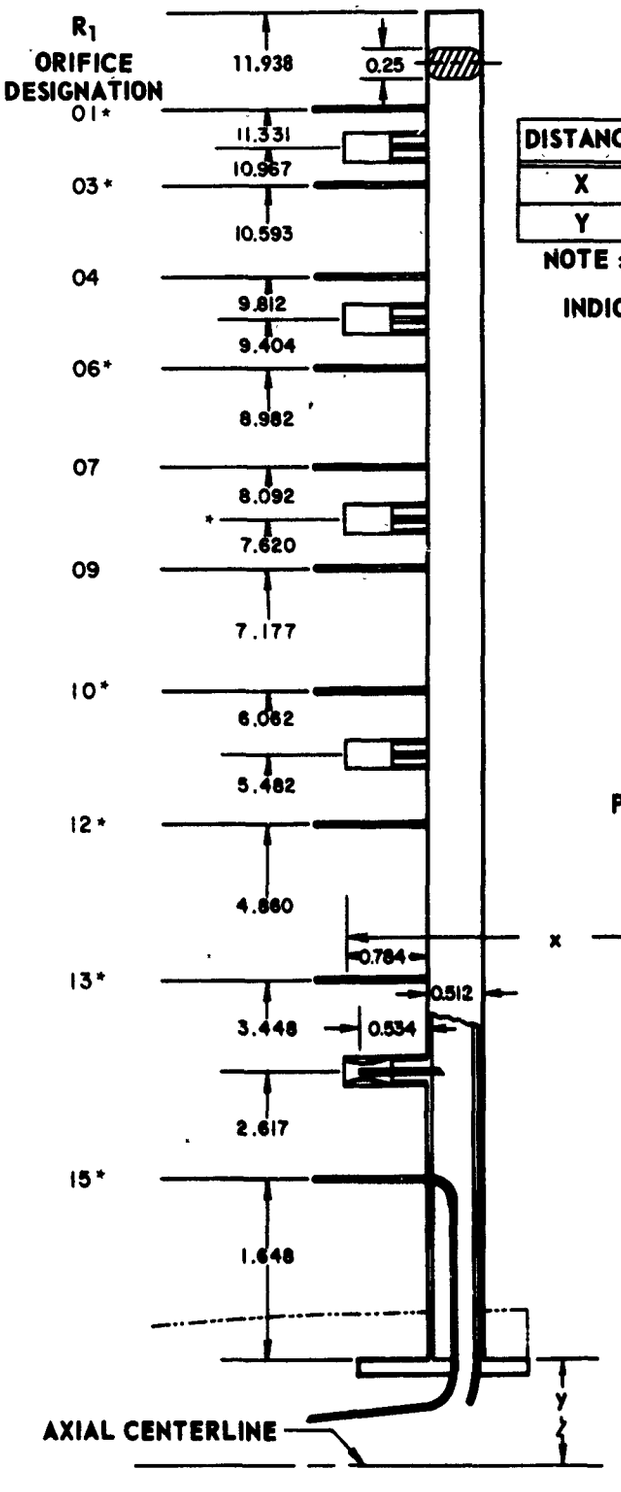
HS VG SHROUDED PROPELLER TEST

PRESSURE SENSING INSTRUMENTATION ARRANGEMENT
VIEW LOOKING DOWNSTREAM



HS VG SHROUDED PROPELLER TEST
PITOT-STATIC RAKE ORIFICE LOCATIONS AND DESIGNATIONS

NOTE : DIMENSIONS SHOWN IN INCHES



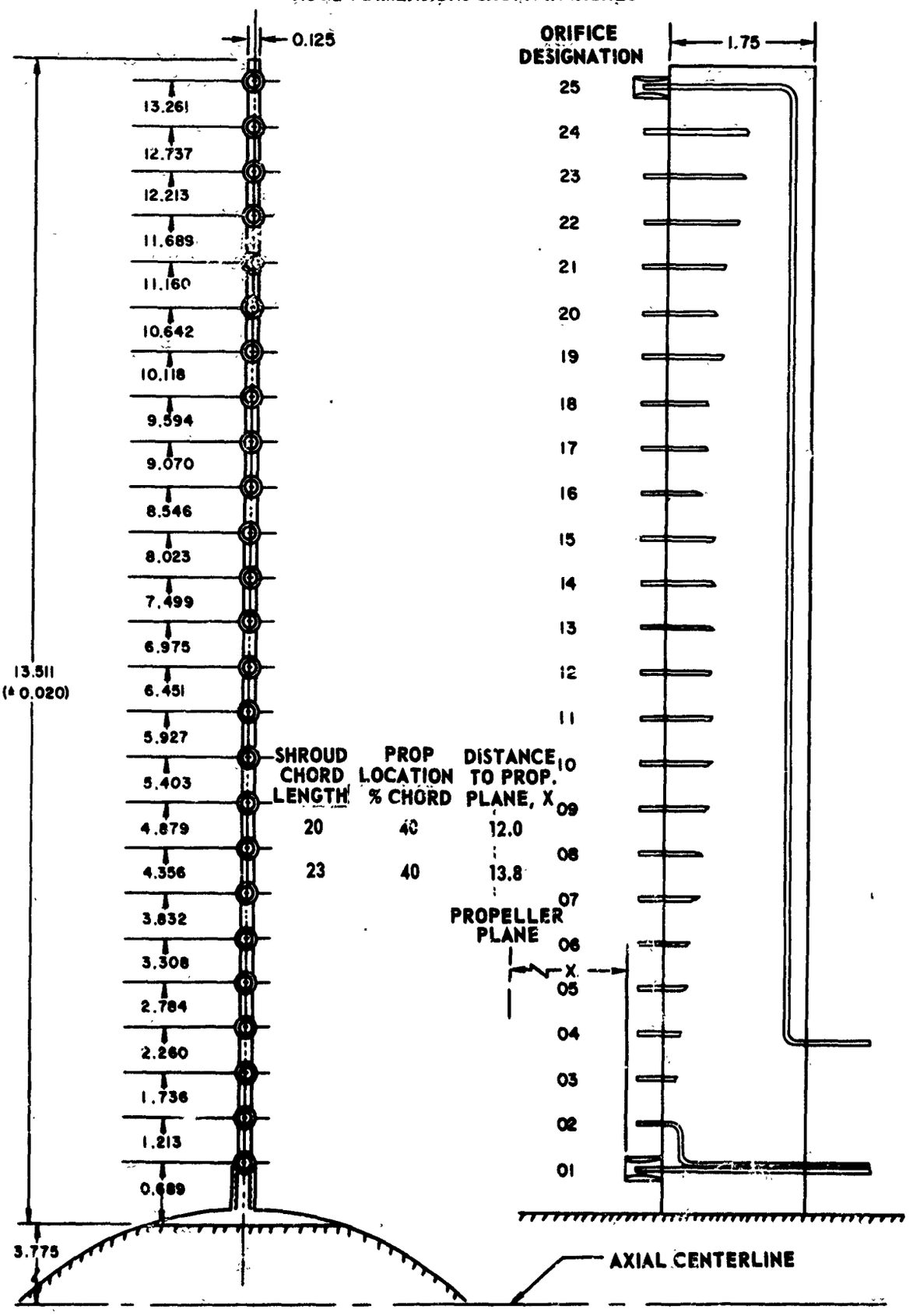
RAKE LOCATIONS

DISTANCE	R_1	R_{E5} (APP. IV)
X	4.28	-12.436
Y	3.039	4.512

NOTE : R_{E5} ORFICES INDICATED BY ASTERISK

BASE OF R_1 RAKE SECURED WITHIN SPINNER
R_{E5} LOCATED UPON 0.5 INCH UNSHEILDED BLOCK AT SHROUD EXIT STATION

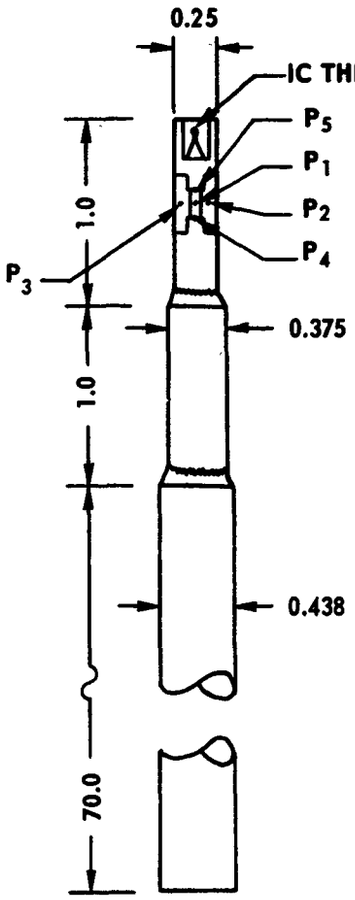
HS VG SHROUDED PROPELLER TEST
EXIT RAKE ORIFICE LOCATIONS AND DESIGNATIONS
NOTE : DIMENSIONS SHOWN IN INCHES

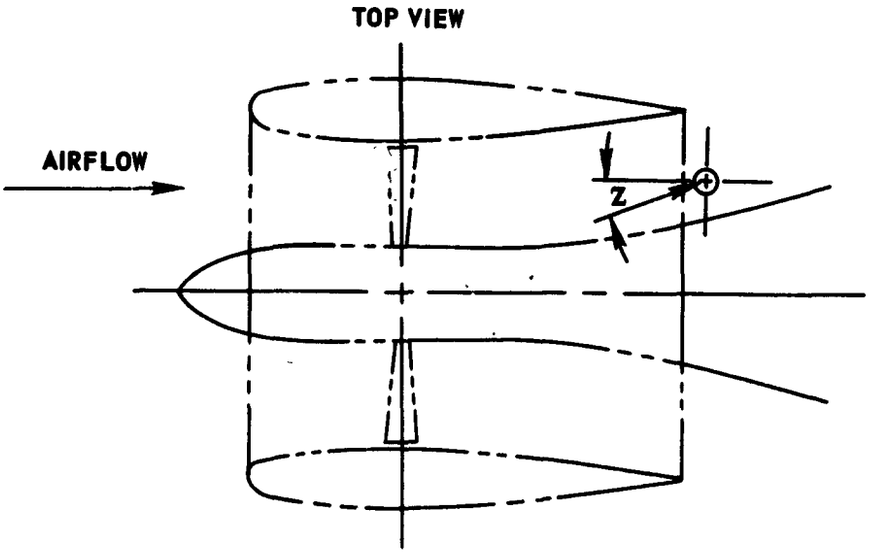


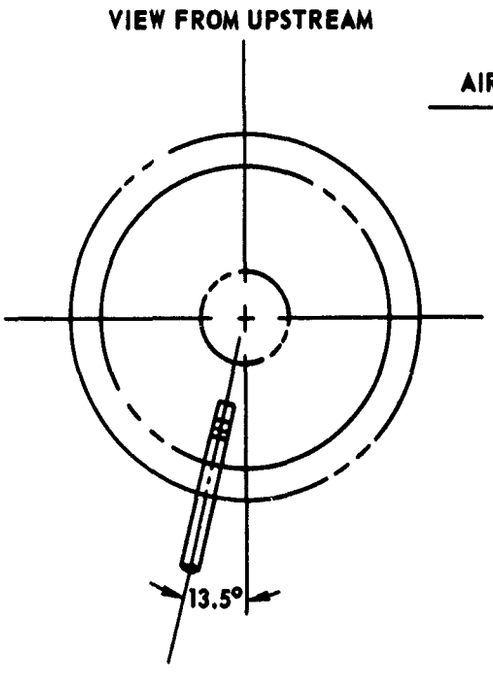
HS VG SHROUDED PROPELLER TEST
TRAVERSING PROBE INSTALLATION

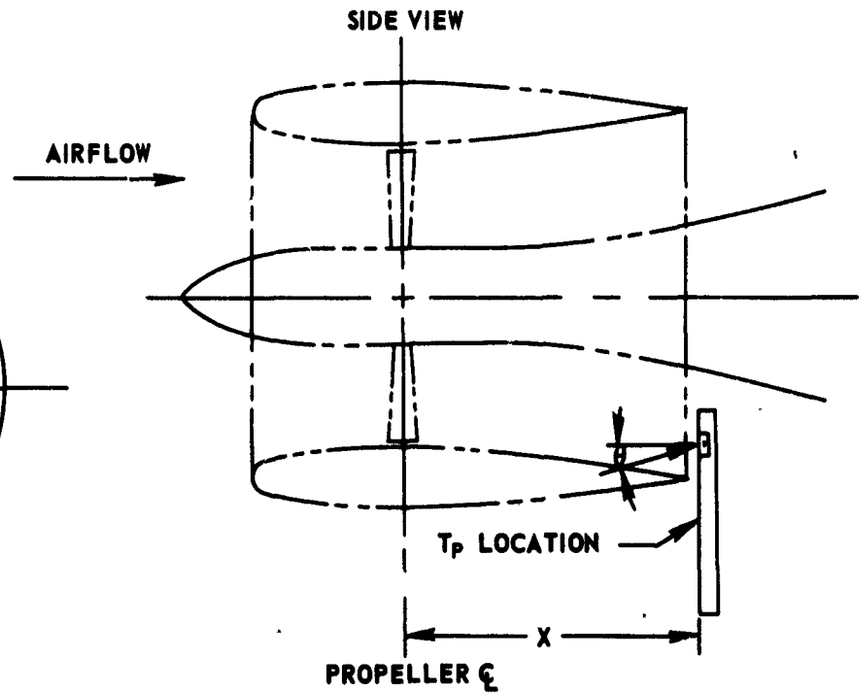
NOTE : DIMENSIONS SHOWN IN INCHES
POSITIVE ANGLES SHOWN

SHROUD CHORD LENGTH	PROP LOCATION % CHORD	DISTANCE TO PROP. PLANE, X
20	40	12.2
23	40	14.0

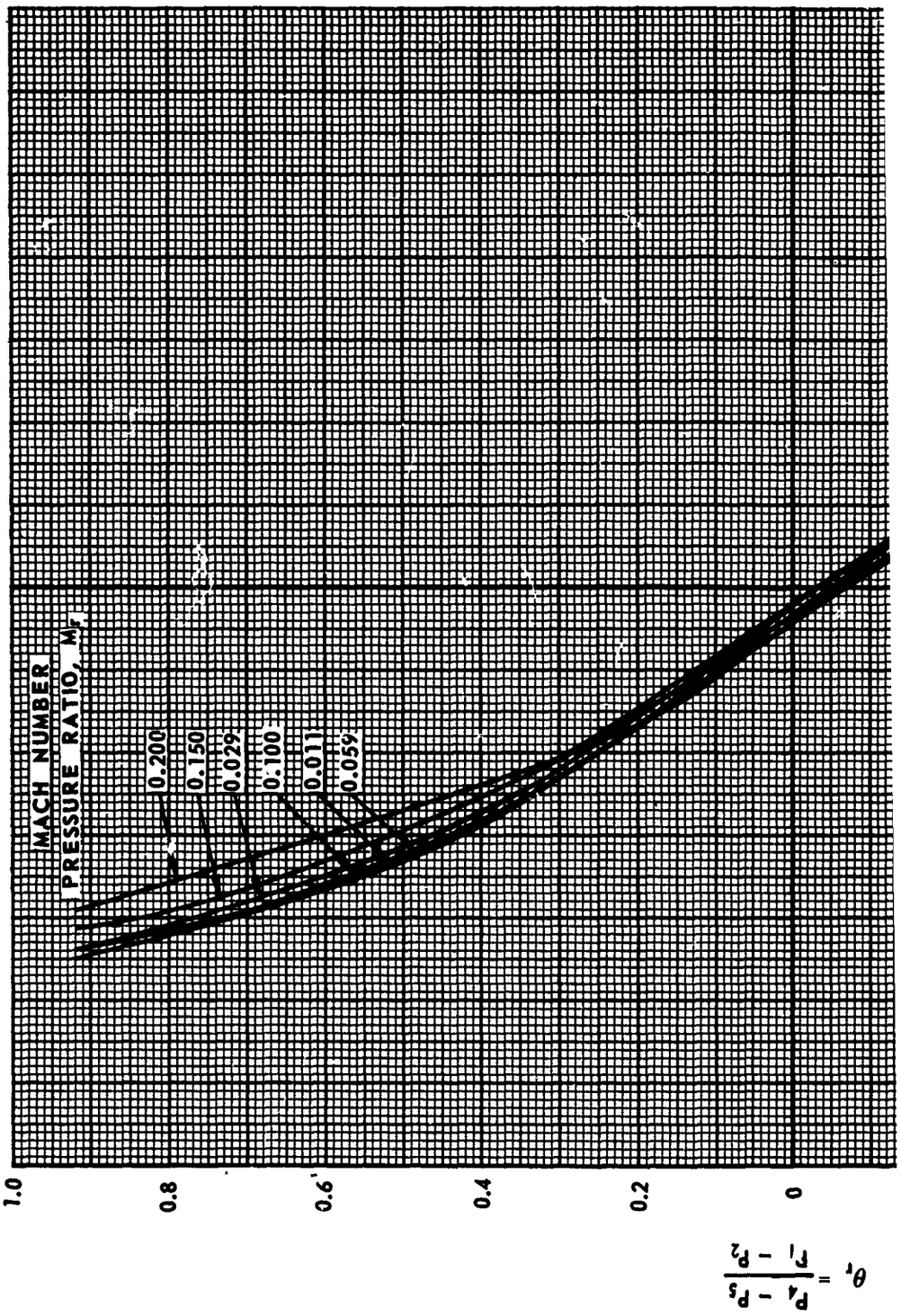








HS VG SHROUDED PROPELLER
TRAVERSING PROBE CALIBRATION CURVES



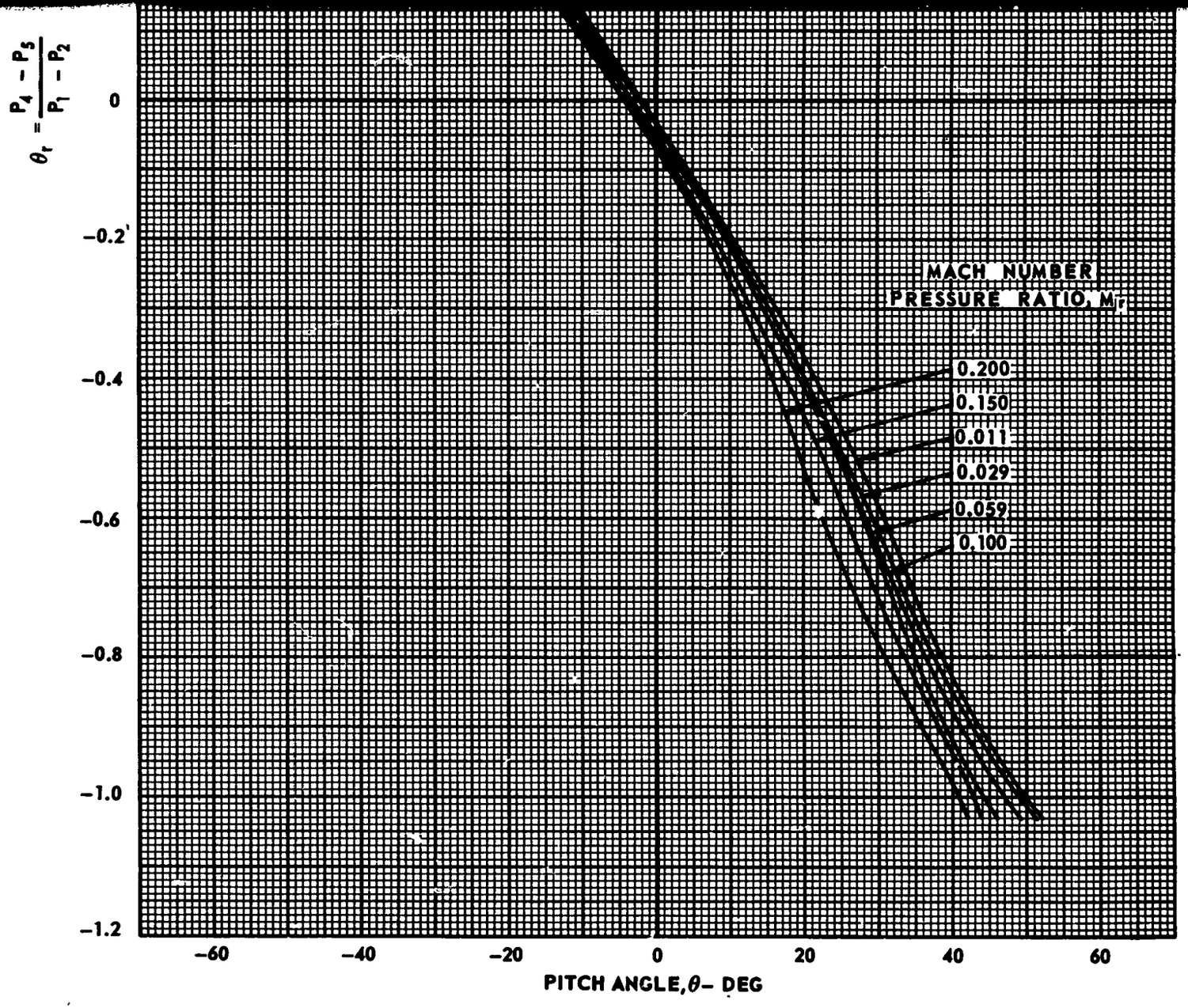
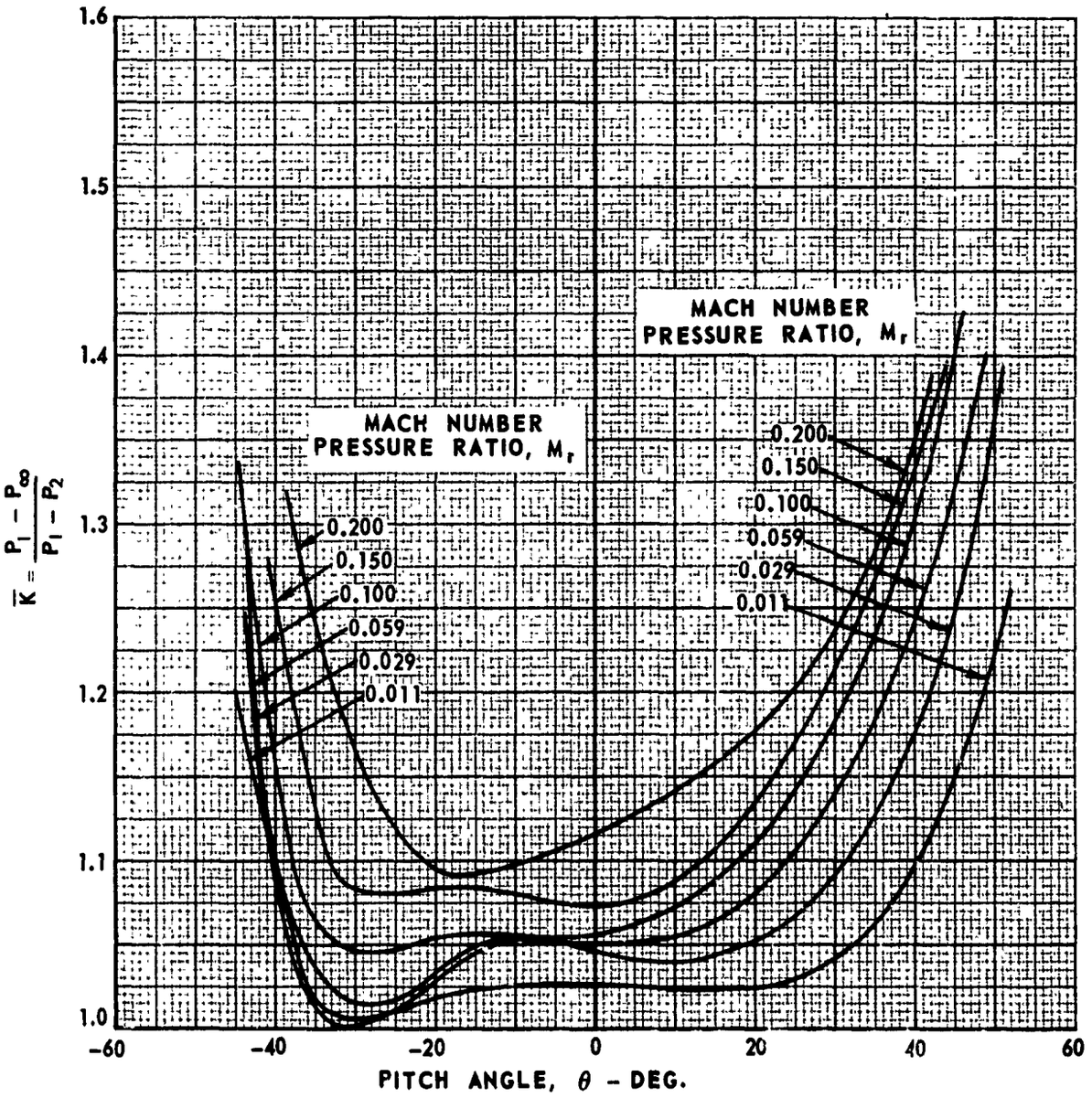

$\theta_r = \frac{P_4 - P_3}{P_1 - P_2}$
0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-60
-40
-20
0
20
40
60
PITCH ANGLE, θ - DEG
MACH NUMBER
PRESSURE RATIO, M_r
0.200
0.150
0.011
0.029
0.059
0.100

FIG. II-5

HS VG SHROUDED PROPELLER TEST
TRAVERSING PROBE CALIBRATION DATA



APPENDIX III

HS VG SHROUDED PROPELLER TEST

Tunnel Blockage Corrections

In the 18-ft test section the average static pressure in the propeller plane at the two vertical walls of the test section was compared with an average of four static pressures on the 45-deg sides of the octagonal test section (speed ring) located 167.56 in. upstream of the propeller plane. This comparison was made with the dynamometer installed in the test section with and without the shroud present. As implied by Fig. III-1, the static pressure at the tunnel walls in the propeller plane does not differ significantly from the upstream value due to the addition of the dynamometer with or without the shroud. Therefore, the desired tunnel speed in the 18-ft test section was set according to the calibration curve, Fig. III-1, using the speed ring as reference and then the desired tunnel speed was analytically corrected for shroud solid and wake blockage and propeller thrust effect. The shroud solid and wake blockage correction was calculated (Appendix VII) to be approximately equal to 0.7 percent (equivalent to the Ref. 4 effect) and it is applied to the data in Fig. III-1 for comparison. This differed from the procedure followed by Ref. 4 where shroud blockage was considered negligible in the 18-ft test section and tunnel speed was set at the propeller plane.

In the 8-ft test section the propeller is farther upstream in the throat of the test section and thus it was not possible to establish an upstream pressure reference which was equal to the test section static pressure without being influenced by the model. The average of three pressures from the speed bump located in the test section bellmouth 81.4 in. upstream of the propeller was selected as the reference pressure. The speed bump data are plotted in Fig. III-2 against data from speed plate orifices in the propeller plane at the upper east inclined wall of the test section for the clear test section and for the dynamometer with and without the shroud. As indicated in Fig. III-2, an increase in speed of approximately three percent is caused by the presence of the dynamometer-shroud combination. Since the dynamometer itself does not significantly increase the propeller plane wall pressure, it appears that its blockage effects are negligible. As it is difficult to accurately determine the tunnelcenterline correction from the measured wall data for a realistic model, a shroud blockage correction based on model geometry was employed. The model geometry term, which approximates the sum of the shroud

APPENDIX III
(Contd.)

solid and wake blockage, is defined as one quarter of the ratio of the total included model frontal area to the test section cross-sectional area (Ref. 6, $\epsilon_S = A_X/4A_T$). This term was selected to be approximately equal in magnitude to the Ref. 4 term. Therefore, the desired tunnel speed in the 8-ft test section was set according to the calibration curve presented in Fig. III-2 using the speed bump as reference and then the desired speed was analytically corrected for shroud solid and wake blockage and propeller thrust effects. The shroud blockage correction was calculated as defined in Appendix VII to be equal to 2.94 percent and it is applied to the data in Fig. III-2 for comparison.

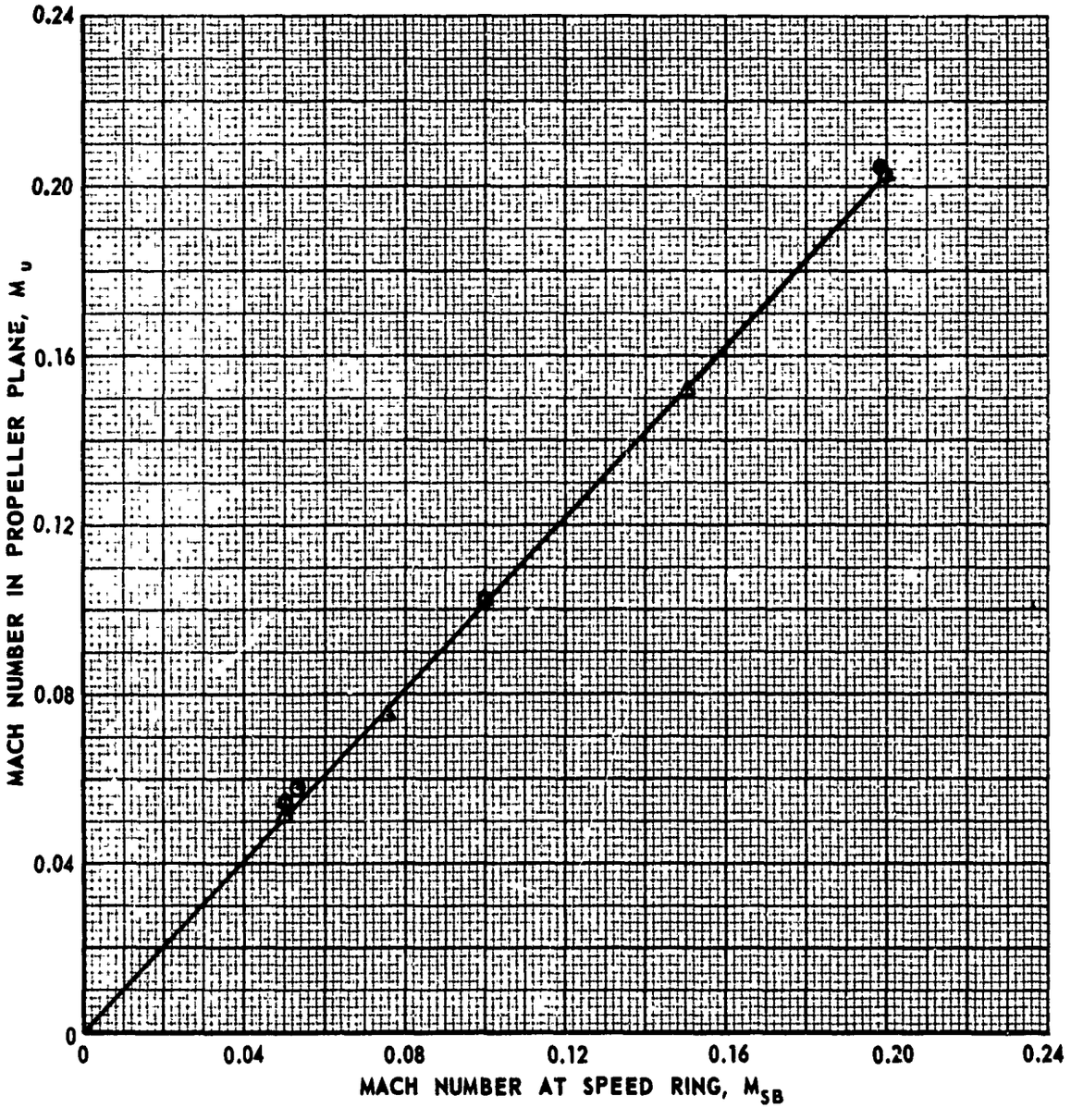
FIG. III-1

HS VG SHROUDED PROPELLER TEST
BLOCKAGE EFFECT OF THE SHROUD

18-FT TEST SECTION

SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	1	VARY	PTR W/O SHROUD + BLADES	—
△	2	↓	$L_5C_1E_8B_4R_1R_E$	↓

NOTE: SOLID SYMBOLS DENOTE DATA WITH SHROUD BLOCKAGE CORRECTIONS APPLIED

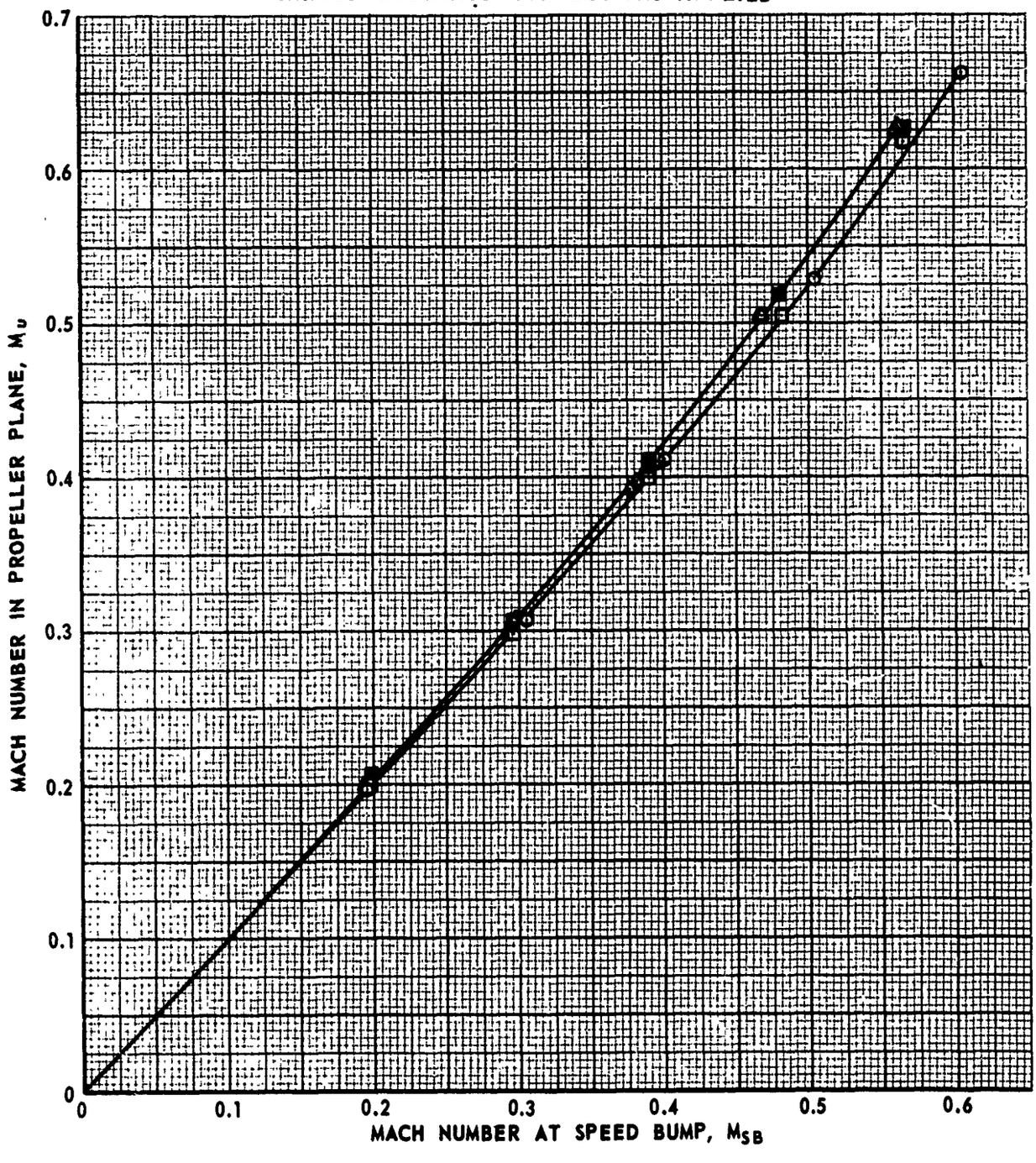


HS VG SHROUDED PROPELLER TEST
BLOCKAGE EFFECT OF PROPELLER DYNAMOMETER WITH AND WITHOUT SHROUD

8-FT TEST SECTION

SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	25	VARY	CLEAR TEST SECTION	—
△	27	↓	$L_4C_1E_7B_4R_1R_E$	↓
⊡	26	↓	PTR W/O SHROUD + BLADES	↓

NOTE: SOLID SYMBOLS DENOTE DATA WITH SHROUD BLOCKAGE CORRECTIONS APPLIED



APPENDIX IV

HS VG SHROUDED PROPELLER TEST

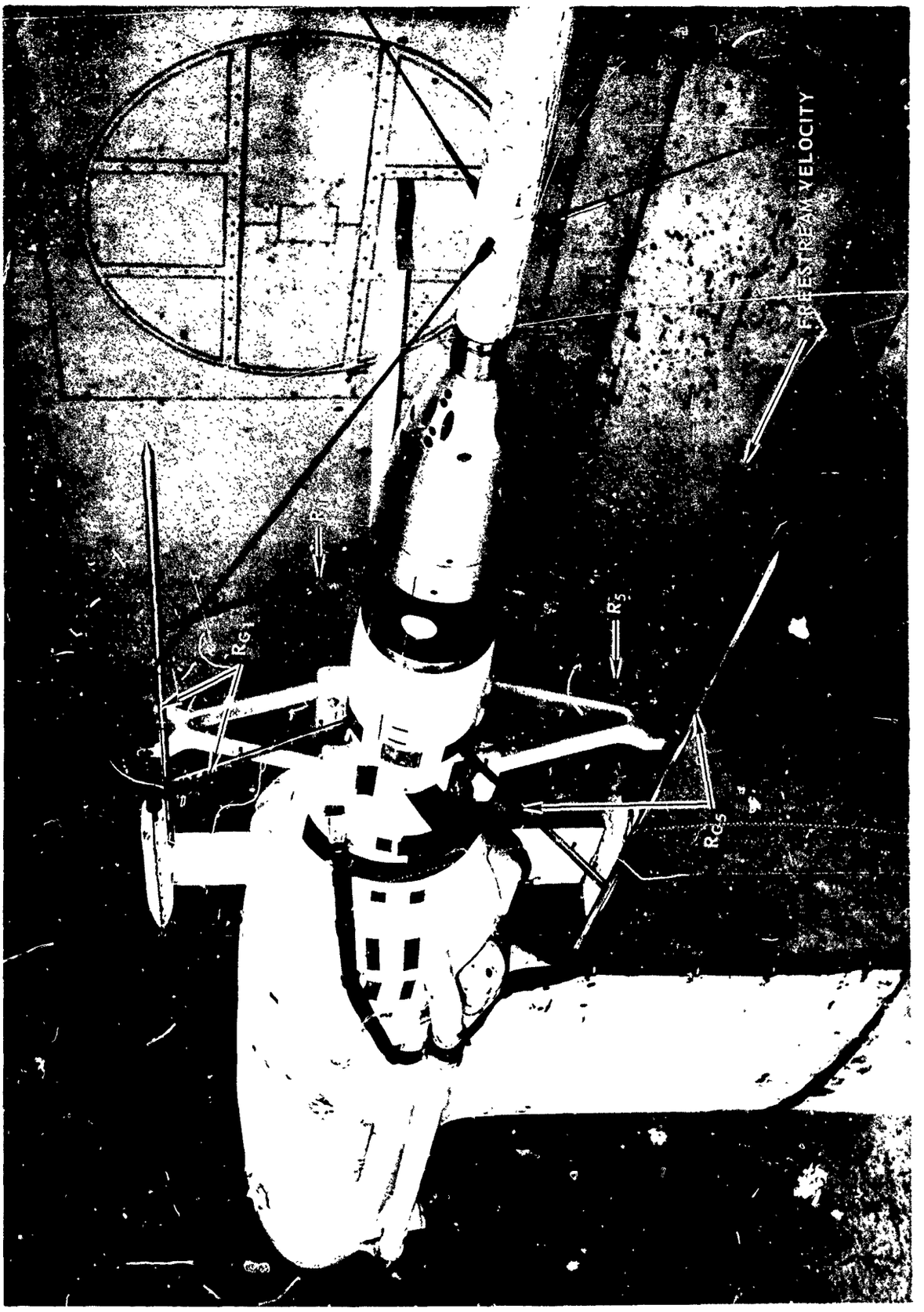
Propeller Dynamometer Buoyancy Investigations

Tunnel calibrations were performed with the dynamometer installed without the shroud or blades in both test sections in order to determine whether an axial pressure gradient existed at the shroud location due to the dynamometer presence. The existence of such a gradient would require that the measured shroud chord force be corrected for a resultant buoyancy drag. It is stated in Ref. 7 that this gradient is very small throughout the test Mach number range and which resulted in a chord force correction coefficient of 0.0016. Subsequently, as this is the magnitude of chord force accuracy, the buoyancy correction was considered negligible in Ref. 4. However, due to the proximity of the trailing edge of the low-speed shroud to the dynamometer cowl and because of the E_6 diffuser is a converging nozzle, further study was deemed necessary for this program.

The axial static pressures along two azimuth positions, 20 and 130 deg, were determined using the two buoyancy rakes shown in Figs. IV-1 and IV-2. The resultant pressure distribution at the shroud location (15.28 in. from the hub centerline) is illustrated in Fig. IV-3. The buoyancy drag force which resulted from the application of these data (Appendix VII and Ref. 6) is presented in Fig. IV-4. This buoyancy drag force represents approximately 0.5 percent of the overall drag felt by this shroud.

Radial velocity profile data at the shroud inlet and exit stations were measured simultaneously with the axial pressure distribution data by the buoyancy rakes. These data were generated to determine if and what type of buoyancy corrections would be necessary for propeller performance data in future test programs. The buoyancy rake data recorded at the shroud exit station were questionable as the downstream rake was situated in the wake of the inlet rake. Exit velocities measured with these rakes were determined assuming the exit plane total pressure equaled free-stream total pressure. The resulting velocity profiles were substantiated at the conclusion of the shroud data phases of the program by comparable data obtained using an inlet pitot-static rake (R_1), an exit pitot-static rake (R_{E_5}), an exit total pressure rake and the traversing probe (Figs. II-2, II-3 and II-4). A composite velocity profile for both shroud stations and each test section Mach number is presented in Figs. IV-5 and IV-6, with typical data point distributions indicated for M = 0.3 and 0.6, respectively.

HS VG SHROUDED PROPELLER TEST
PROPELLER DYNANOMETER WITH BOUYANCY RAKES



HS VG SHROUDED PROPELLER TEST

BOUYANCY RAKE ORIFICE LOCATIONS AND DESIGNATIONS

NOTE : DIMENSIONS SHOWN IN INCHES

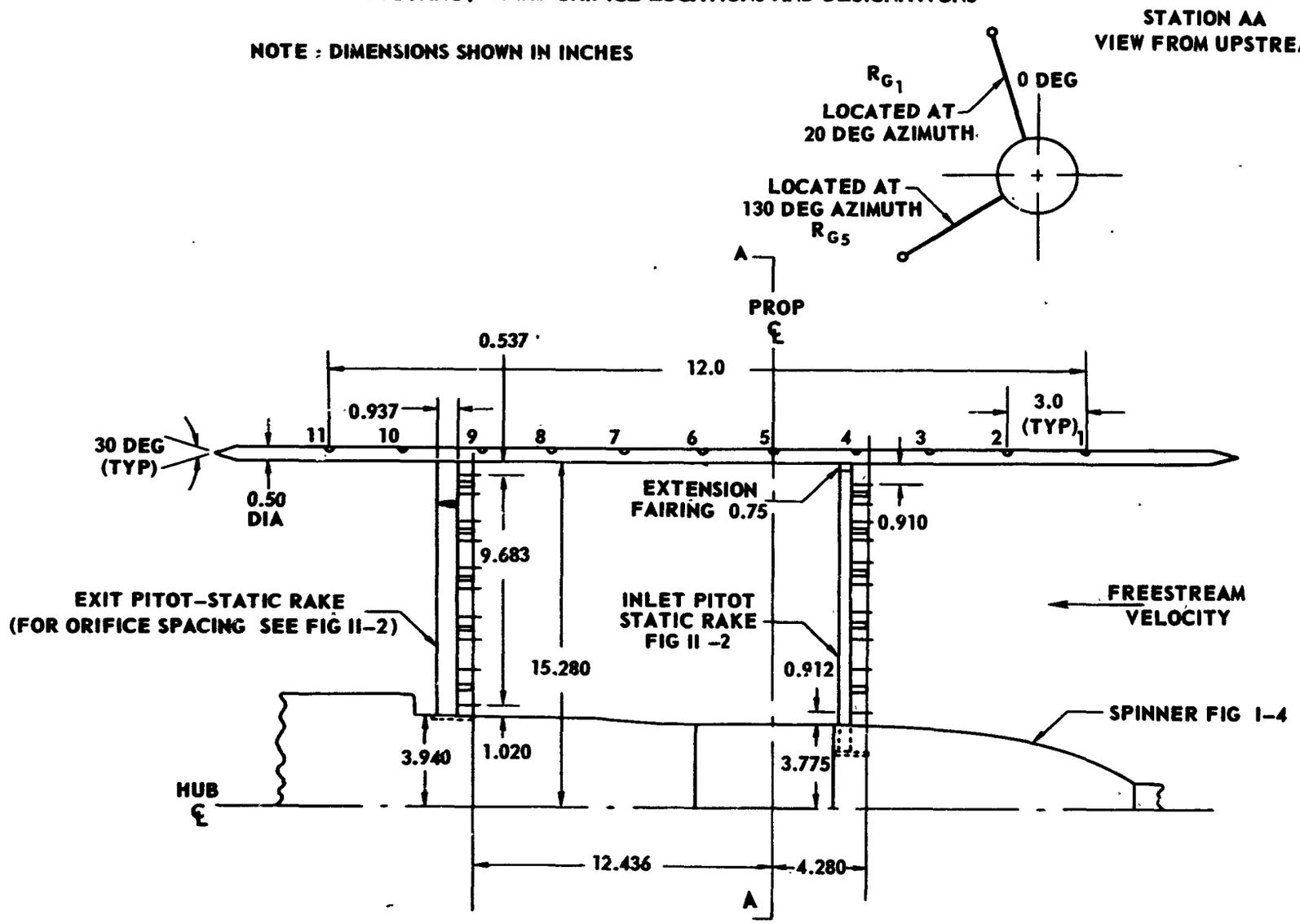
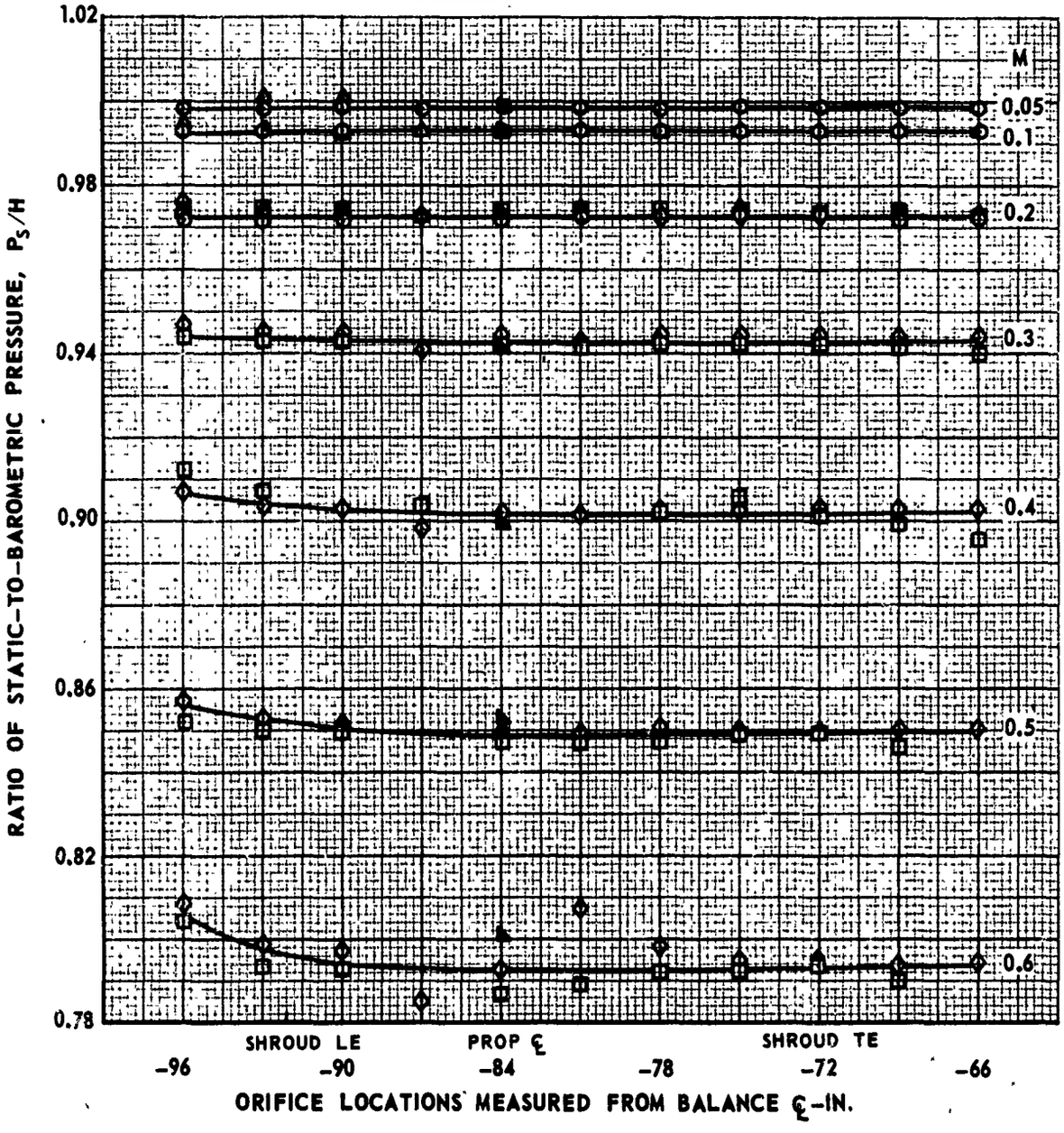


FIG. IV-3

HS VG SHROUDED PROPELLER TEST
AXIAL STATIC PRESSURE DISTRIBUTION AT SHROUD STATION
PROPELLER TEST RIG WITHOUT SHROUD

SYM	RAKE	AZIMUTH	TS
⊙	R_{G_1}	20	18
△	R_{G_5}	130	18
⊡	R_{G_1}	20	8
◇	R_{G_5}	130	8

NOTE : CLOSED SYMBOLS (▲) DENOTE P_∞ /H



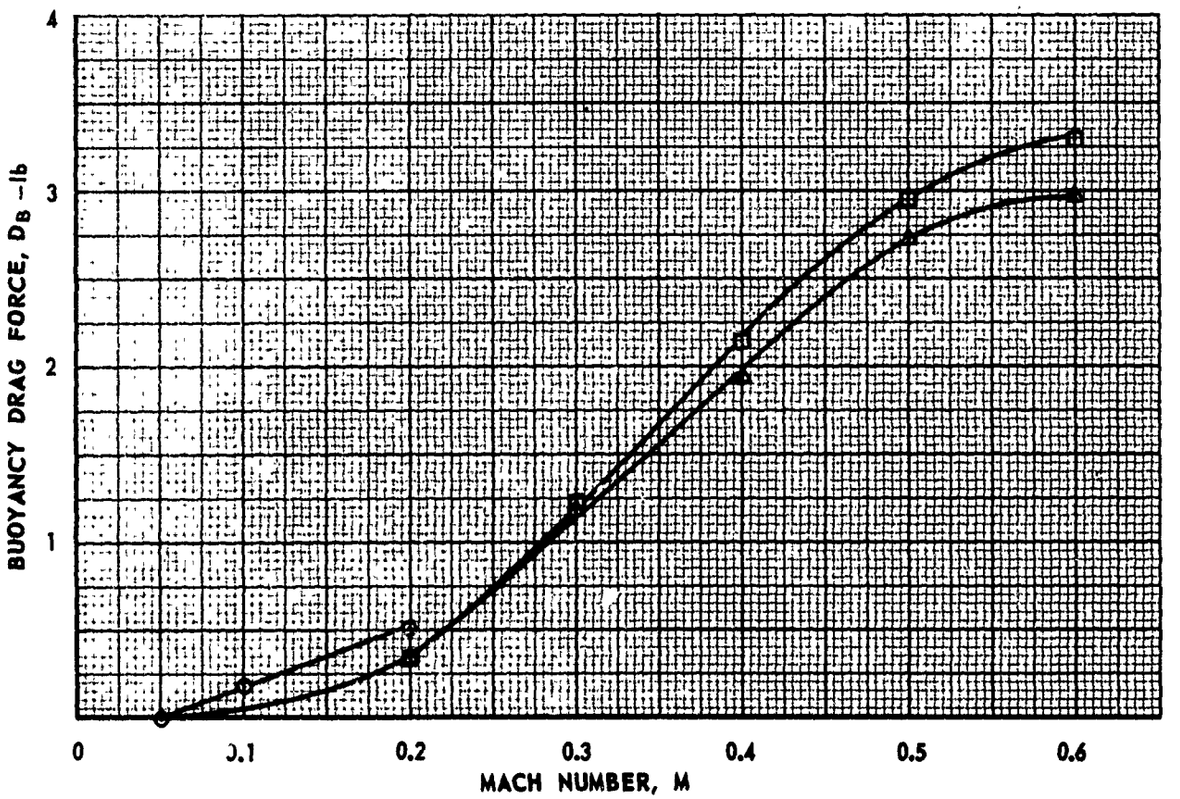
HS VG SHROUDED PROPELLER TEST

BUOYANCY DATA

EVALUATED BY METHOD OF AREA SUMMATIONS

$$D_B = -\pi \bar{d} \sum_i S_i \left(\frac{\Delta P}{\Delta X}\right)_i \quad \text{REF. 6}$$

SYM	SHROUD	TS
⊙	$L_5C_1E_8$	18
△	$L_4C_1E_7$	8
⊡	$L_4C_1E_6$	8



HS VG SHROUDED PROPELLER TEST
VELOCITY PROFILES AT THE SHROUD INLET AND EXIT STATIONS
PROPELLER TEST RIG WITHOUT SHROUD

NOTE: SOLID LINES AND OPEN SYMBOLS DENOTE INLET VELOCITIES

DASHED LINES AND SOLID SYMBOLS DENOTE EXIT VELOCITIES

SYM	RUN	RAKE
⊙	26	R_{G_1}
△	26	R_{G_5}
⊡	85	R_{G_1}
◇	85	R_{E_5}

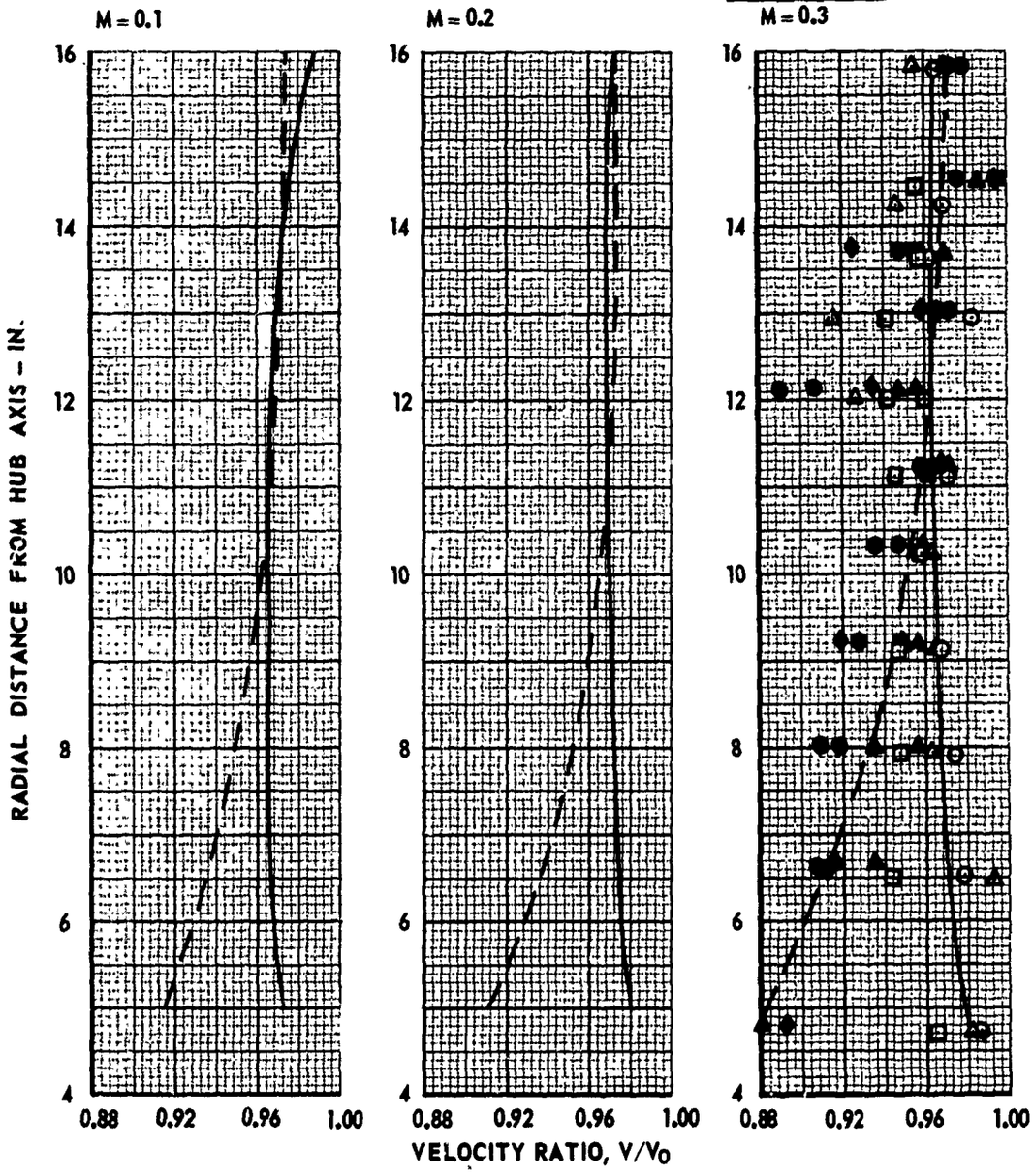


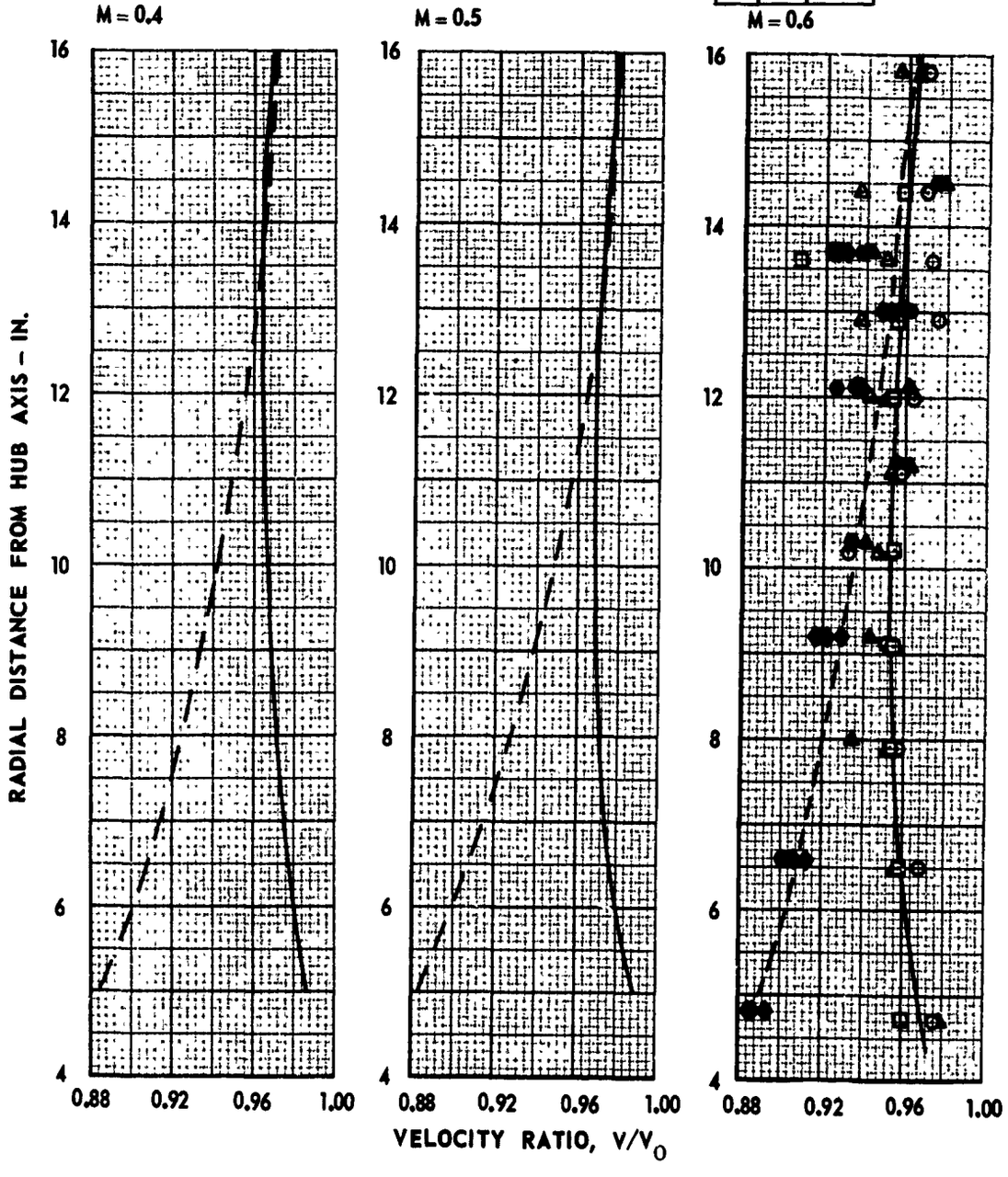
FIG. IV-6

HS VG SHROUDED PROPELLER TEST
VELOCITY PROFILES AT THE SHROUD INLET AND EXIT STATIONS
PROPELLER TEST RIG WITHOUT SHROUD

NOTE: SOLID LINES AND OPEN SYMBOLS DENOTE INLET VELOCITIES

DASHED LINES AND SOLID SYMBOLS DENOTE EXIT VELOCITIES

SYM	RUN	RAKE
⊙	26	R_{G_1}
△	26	R_{G_5}
⊡	87	R_{G_1}
◇	87	R_{E_5}



APPENDIX V

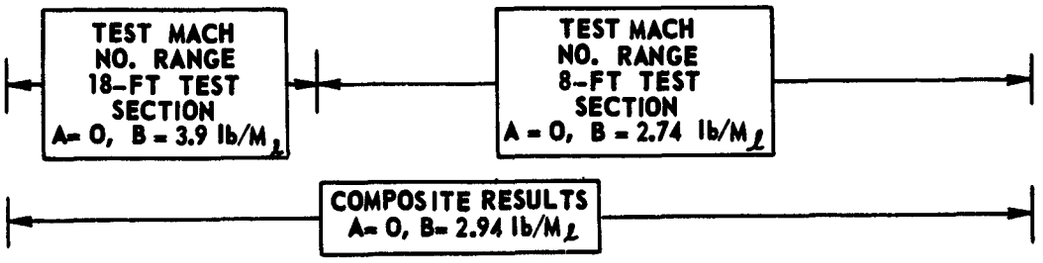
HS VG SHROUDED PROPELLER TEST

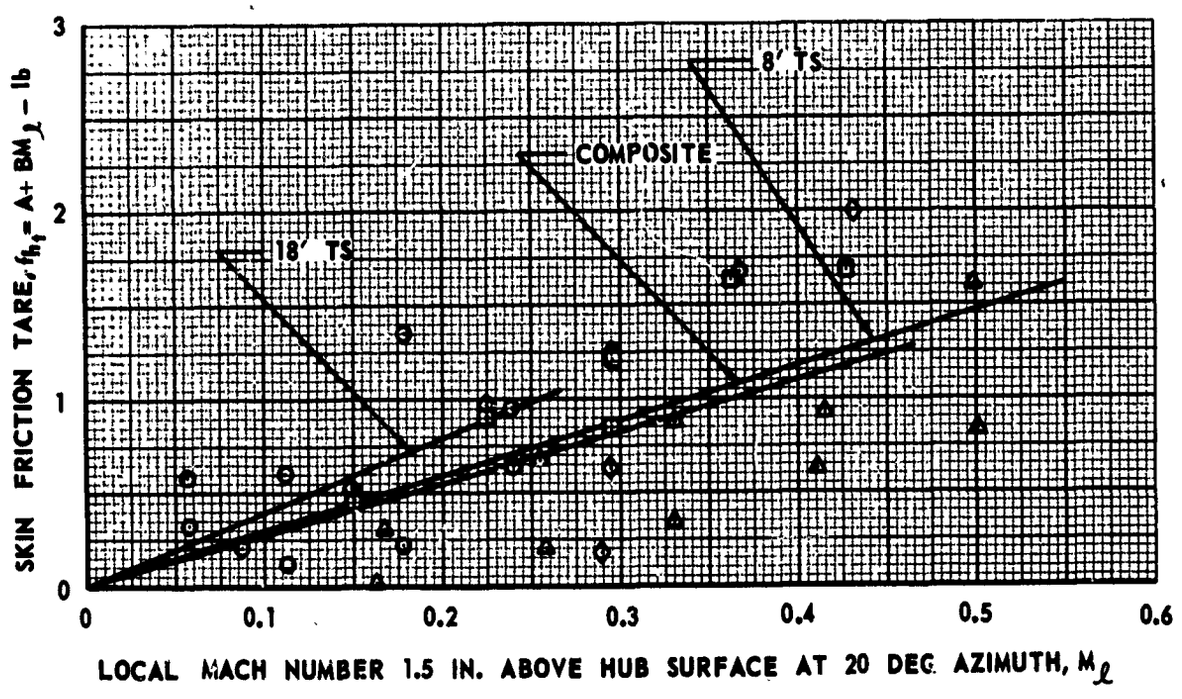
Propeller Hub Skin Friction Tare

The forces measured by the dynamometer's thrust balance represent a summation of the propeller thrust, a hub skin friction drag and a thrust force derived from the pressure differential across the hub. The pressure differential thrust is determined from direct measurement of the pressures across the hub at each data point. The hub skin friction drag tare was determined from a calibration made without blades through a Mach number range at zero hub rotational speed. The gross thrust measured during this calibration is equal to the independently measured pressure thrust and the skin friction drag since the propeller thrust is equal to zero. Hub skin friction tare values measured in this manner are shown in Fig. V-1. Due to scatter in the data generated in both test sections, a composite linear function of local Mach number was fitted to the overall data as shown in this plot. The individual test section values of the tare parameters are included for comparison. The values derived from the composite were used in the final data reduction equations, Appendix VII. Local Mach number was selected as the independent variable rather than tunnel speed in order to account for the effect due to the shroud presence. It should be noted that the intention in so defining the hub skin friction as a function of local Mach number was to simplify computer application of the data and, further, that the included results are applicable only with the finite spinner.

HS VG SHROUDED PROPELLER TEST
PROPELLER HUB SKIN FRICTION TARE

SYM	RUN NO.	CONFIGURATION	TS
⊙	2	$L_5C_1E_8B_4R_1R_E$	18
△	27	$L_4C_1E_7B_4R_1R_E$	8
⊡	81	$L_4C_1E_6B_4R_1R_E$	↓
◇	82	$L_4C_1E_6B_4R_1R_ER_{E_5}$	↓





APPENDIX VI

HS VG SHROUDED PROPELLER TEST

Shroud Support Tare and Interference Effects

The tare and interference effects of the shroud support system are presented in this appendix for the three shroud configurations tested. The support system consisted of a side arm and two "A"-frame attachment points as illustrated in Fig. 3. The interference effects (no tare effect applicable) of the side arm support were evaluated in a previous test (Ref. 4) and found to be negligible and corrections for these effects were not applied to the performance data presented in this report. Unlike the side arm interference, the "A"-frame tare and interference effects were found to be significant to chord force measurements. Derivation of the "A"-frame tare and interference effects were achieved from two methods: a) the tare produced from the air loads on the isolated "A"-frames and b) the tare and interference produced from the airloads on the "A"-frames, shown in Fig. VI-1, in proximity of the three shroud configurations.

Concurrent with the dynamometer buoyancy investigations an "A"-frame correction to chord force was obtained based on chord force measurements of the two isolated (no shroud) "A"-frames rather than from the dummy "A"-frame image. This technique was developed in a previous test (Ref. 4) because of the inconsistencies in the data obtained with the image system, and the direct measurements were made of the isolated system to improve the correction.

With the measurements of "A"-frame chord force presented in Fig. VI-2 and the approach described in Ref. 8, a chord force correction as a function of propeller advance ratio and thrust coefficient was derived as given in Eq. 9 of Appendix VII. The correction does not include the "interference" of tare and interference (shroud not present), nor does it account for changes associated with variations in "A"-frame shroud attachment proximities. However, these effects were checked by measuring the effects of the airloads on the dummy "A"-frame system in proximity of each of the three shroud configurations. These effects were determined by obtaining the difference in shroud chord force coefficient without and with a single dummy "A"-frame installed (this configuration produces half of the effect of the two "A"-frames). These differences compared poorly with the results obtained from the isolated "A"-frames because the predetermined values of the drag parameter were based on the free-stream Mach number.

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FIG. V1-1

HS VG SHROUDED PROPELLER TEST

"A"- FRAME IMAGE SYSTEM

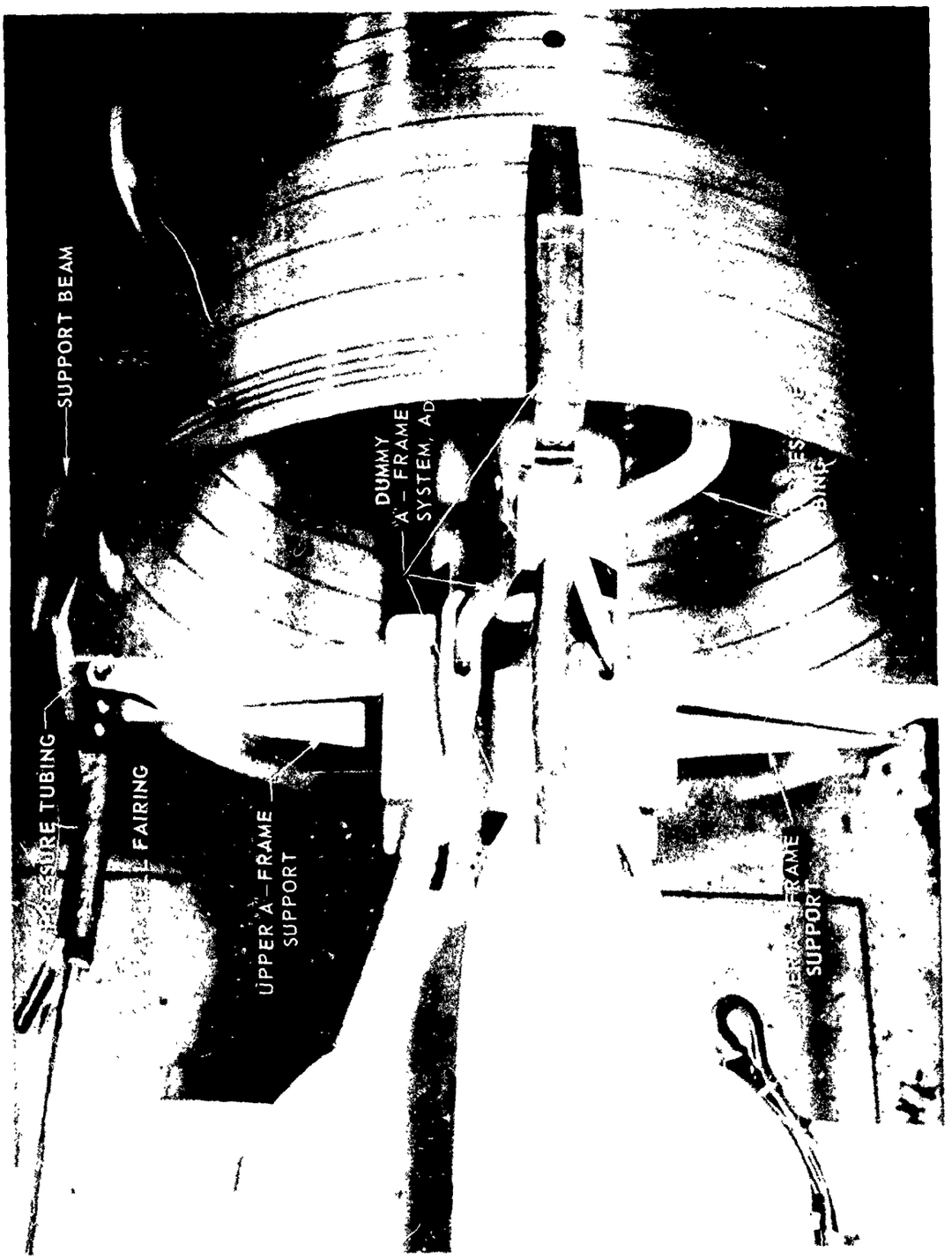


FIG. VI-2

HS VG SHROUDED PROPELLER TEST

"A" – FRAME DRAG TARE

$$C_{c_f} = \left[e + f\left(\frac{C_T}{J^2}\right)\right] J^2 \qquad \text{(APP VII EQ. 9)}$$

WHERE $f = 2.71e$

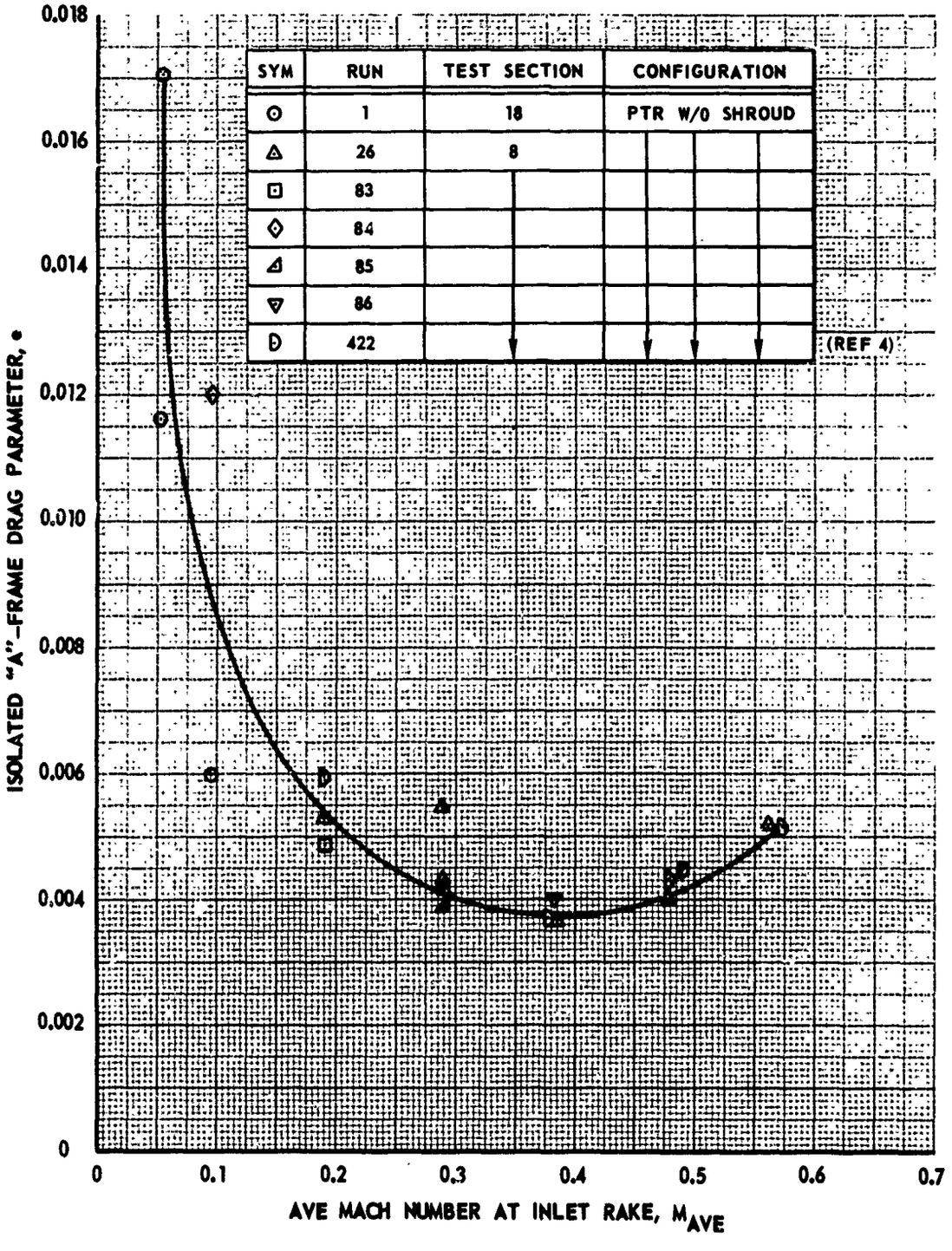


FIG. VI-3

HS VG SHROUDED PROPELLER TEST
COMPARISON OF "A" - FRAME TARE CORRECTION WITH TEST DATA

SYM	RUN NO.	MACH NO.	CONFIGURATION	$\beta_{3/4}$
⊙	13	0.02	$L_5 C_1 E_8 B_3 P_{WT} T_1 R_1 R_E$	36.0
△	16	↓	$L_5 C_1 E_8 B_3 P_{WT} T_1 R_1 A_D$	↓

NOTES: OPEN CIRCLE SYMBOLS - UNCORRECTED DATA, STANDARD SUPPORT SYSTEM.
OPEN TRIANGLE SYMBOLS - UNCORRECTED DATA, DUMMY "A"-FRAME ADDED.
SOLID SYMBOLS - DATA WITH DUMMY "A"-FRAME CORRECTED FOR ONE ISOLATED "A"-FRAME.

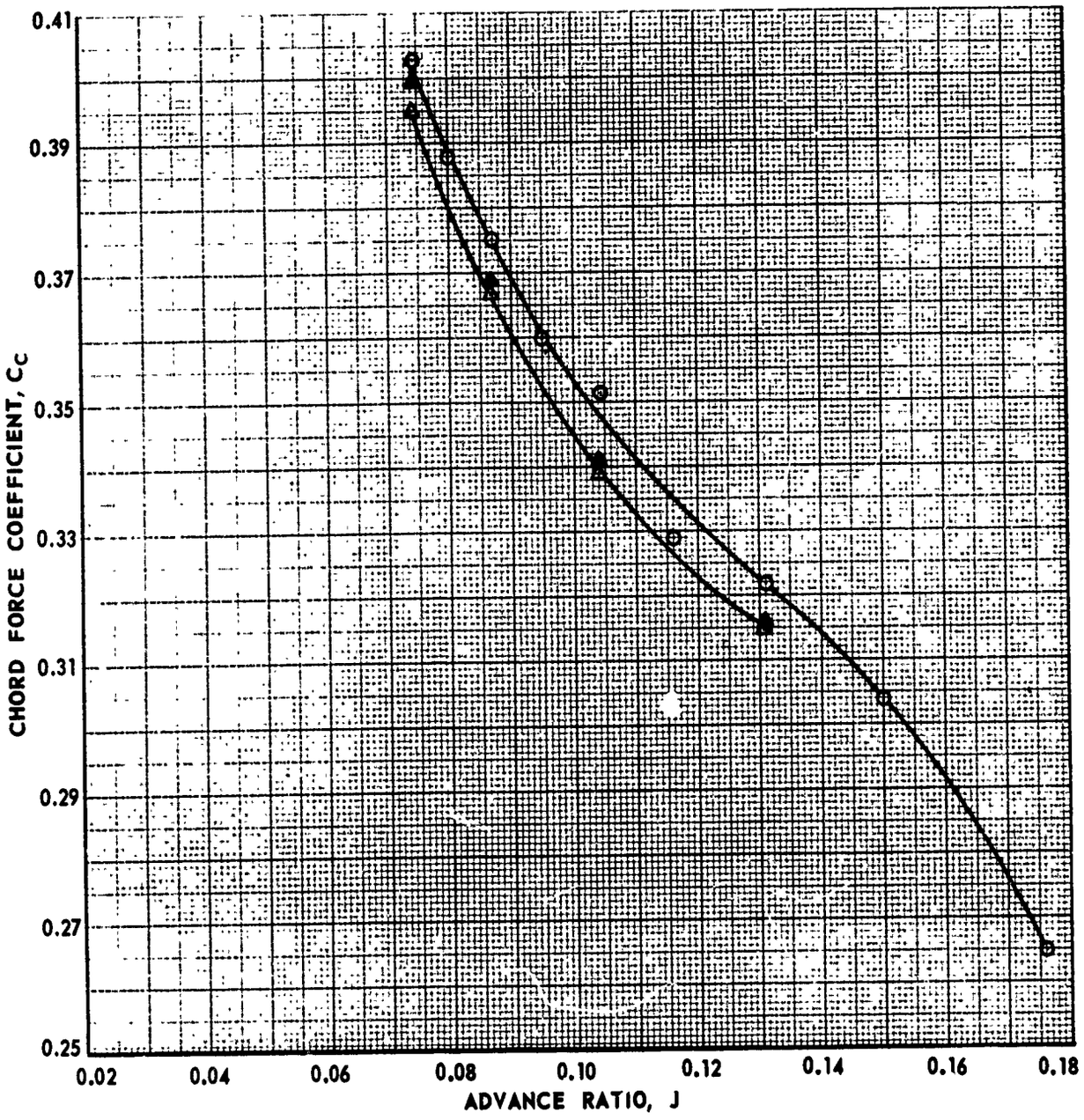


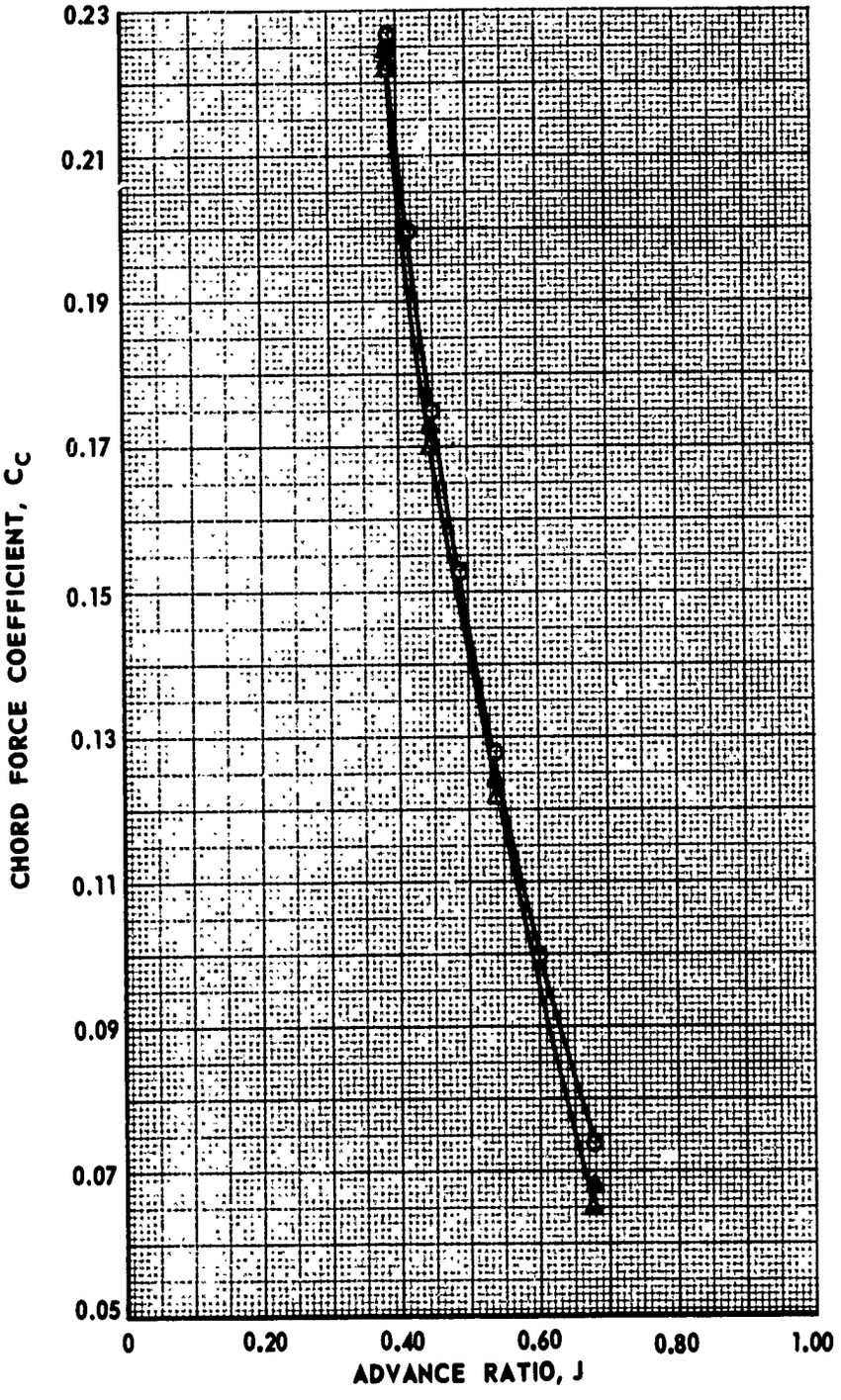
FIG. VI-4

HS VG SHROUDED PROPELLER TEST

COMPARISON OF "A" - FRAME TARE CORRECTION WITH TEST DATA

SYM	RUN NO.	MACH NO.	CONFIGURATION	θ 3/4
⊙	11	0.10	$L_5 C_1 E_8 B_3 P_{WT} T_1 R_1 R_E$	36.0
△	15	↓	$L_5 C_1 E_8 B_3 P_{WT} T_1 R_1 A_D$	↓

NOTES: OPEN CIRCLE SYMBOLS - UNCORRECTED DATA, STANDARD SUPPORT SYSTEM.
OPEN TRIANGLE SYMBOLS - UNCORRECTED DATA, DUMMY "A"-FRAME ADDED.
SOLID SYMBOLS - DATA WITH DUMMY "A"-FRAME CORRECTED FOR ONE ISOLATED "A"-FRAME.



F331012-1

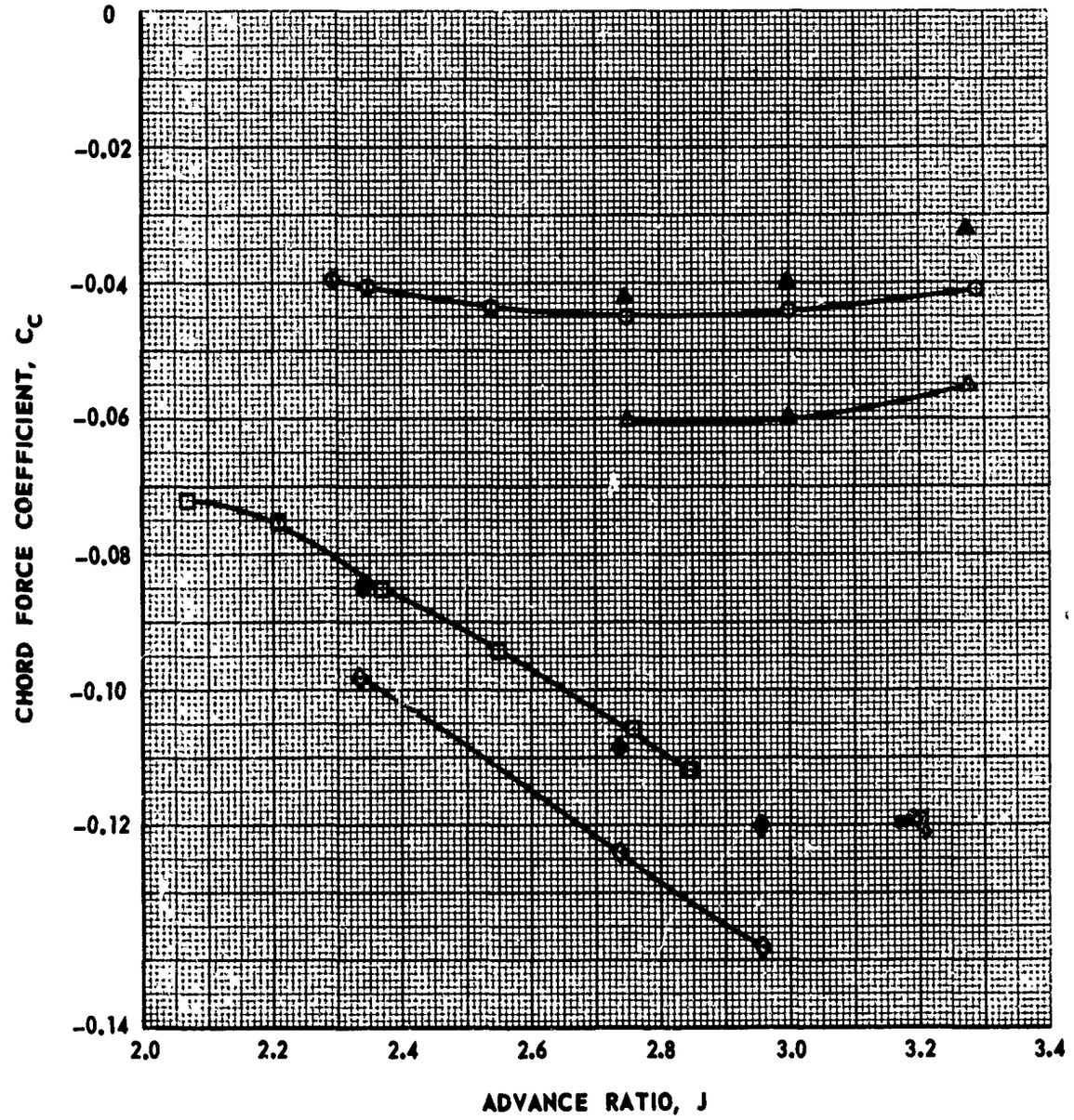
FIG. VI-6

HS VG SHROUDED PROPELLER TEST

COMPARISON OF "A" - FRAME TARE CORRECTION WITH TEST DATA

SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	46	0.60	$L_4 C_1 E_7 B_3 P_{NT} T_2 R_1 R_E$	49.0
△	50	↓	$L_4 C_1 E_7 B_3 P_{NT} T_2 R_1 A_D$	↓
□	65	↓	$L_4 C_1 E_6 B_3 P_{NT} T_2 R_1 R_E$	41.0
◇	74	↓	$L_4 C_1 E_6 B_3 P_{NT} T_2 R_1 A_D$	↓

NOTES: OPEN CIRCLE AND SQUARE SYMBOLS - UNCORRECTED DATA, STANDARD SUPPORT SYSTEM.
OPEN TRIANGLE AND DIAMOND SYMBOLS - UNCORRECTED DATA, DUMMY "A"-FRAME ADDED.
SOLID SYMBOLS - DATA WITH DUMMY "A"-FRAME CORRECTED FOR ONE ISOLATED "A"-FRAME.



APPENDIX V11
HS VG SHROUDED PROPELLER TEST
DATA REDUCTION EQUATIONS

I – PRELIMINARY CALCULATIONS

$$\rho_O = \frac{H}{RT_{SC}} \tag{1}$$

$$\rho = \rho_O \left[\frac{\gamma g R T_{SC}}{1 + \frac{\gamma - 1}{2} M^2} \right]^{-\frac{1}{\gamma - 1}} \tag{2}$$

$$V_u = M \left[\frac{\gamma g R T_{SC}}{1 + \frac{\gamma - 1}{2} M^2} \right]^{0.5} \tag{3}$$

$$V_O = V_u \left[1 + \frac{A_X}{4A_T} - \frac{T_{NET}}{4A_T q_u \left[1 + \frac{T_{NET}}{q_u A_P} \right]^{0.5}} \right] \tag{4}$$

WHERE $T_{NET} = T + C$, (T AND C DEFINED IN EQS. 10 AND 12)

AND $q_u = \frac{\rho V_u^2}{2}$

II CONVERSION OF STRAIN GAGE READINGS

$$T_P = K_2 (T_R - T_O) \tag{5}$$

$$Q_P = K_1 (Q_R - Q_O) \tag{6}$$

$$C_u = K_7 (C_{4_R} - C_{4_O}) + K_8 (C_{5_R} - C_{5_O}) \tag{7}$$

III HUB SKIN FRICTION AND "A" - FRAME TARE AND INTERFERENCE

$$f_{h_t} = A + BM_\ell \tag{8}$$

WHERE $\frac{P_{s_\ell}}{P_{t_\ell}} = \frac{H - K_{10}(P_{s_{\ell R}} - P_{s_{\ell O}})}{H - K_9 (P_{t_{\ell R}} - P_{t_{\ell O}})}$

AND $M_\ell = \left[\frac{(P_{s_\ell} / P_{t_\ell})^{-\frac{\gamma - 1}{\gamma}} - 1}{\frac{\gamma - 1}{2}} \right]^{0.5}$

APPENDIX V11
(CONTD)

$$C_{C_t} = \left[e + f\left(\frac{C_T}{J^2}\right)\right] J^2 \tag{9}$$

IV HUB SKIN FRICTION, BALANCE INTERACTIONS AND HUB AND PTR BUOYANCY CORRECTIONS

$$T = T_P + f_{h_t} - K_3(\Delta T_R - \Delta T_0) - Q_P q_t \tag{10}$$

WHERE $\Delta T_R = K(P_1 - P_4)$

$$Q = Q_P - T_P f_q \tag{11}$$

$$C = C_u + D_B \tag{12}$$

WHERE $D_B = -\pi \bar{d} \sum_i S_i \left(\frac{\Delta P}{\Delta X}\right)_i$

V CONVERSION OF FORCE COMPONENTS TO PERFORMANCE PARAMETERS

$$n = \frac{\bar{N}}{60} \tag{13}$$

$$C_T = \frac{T}{\rho n^2 a_p{}^4} \tag{14}$$

$$C_P = \frac{2\pi Q}{\rho n^2 d_p{}^5} \tag{15}$$

$$C_C = \frac{C}{\rho n^2 d_p{}^4} + C_{Ct} \tag{16}$$

$$C_{T_{NET}} = C_T + C_C \tag{17}$$

$$J = \frac{V_0}{n d_p} \tag{18}$$

$$\eta = \frac{C_T}{C_P} J \tag{19}$$

$$\eta_{NET} = \frac{C_{T_{NET}}}{C_P} J$$

$$HP = \frac{\bar{N} Q}{5252} \tag{21}$$

APPENDIX V11
(CONTD)

$$V_T = \pi n d_p \tag{22}$$

VI CALCULATION OF FREESTREAM VALUES (PRESSURE DATA) AND PRESSURE COEFFICIENT

$$\rho_u = \rho_0 \left(\frac{P_{SB}}{H}\right)^{\frac{1}{\gamma}} \tag{23}$$

WHERE $\rho_0 = \dfrac{H}{RT_{SC}}$

$$V_u = M_u \left[\frac{\gamma g R T_{SC}}{1 + \frac{\gamma-1}{2} M_u^2}\right]^{0.5} \tag{24}$$

WHERE $M_u = f(M_{SB})$ FROM APP III, FIG III-1 AND FIG III-2

AND $$M_{SB} = \left[\frac{(P_{SB}/H)^{-\frac{\gamma-1}{\gamma}} - 1}{\frac{\gamma-1}{2}}\right]^{0.5}$$

$$q_\infty = q_u \left(1 + \frac{Ax}{2A_T}\right) \tag{25}$$

WHERE $q_u = \dfrac{\rho_u V_u^2}{2}$

$$q_\infty = \frac{\gamma}{2} H M_\infty^2 \left(1 + \frac{\gamma-1}{2} M_\infty^2\right)^{-\frac{\gamma}{\gamma-1}} \quad \text{(SOLVED FOR } M_\infty\text{)} \tag{26}$$

$$P_\infty = H \left(1 + \frac{\gamma-1}{2} M_\infty^2\right)^{-\frac{\gamma}{\gamma-1}} \tag{27}$$

$$V_\infty = \left(\frac{2q_\infty}{\rho}\right)^{0.5} \tag{28}$$

WHERE $\rho = \rho_0 \left(\dfrac{P_\infty}{H}\right)^{\frac{1}{\gamma}}$

$$C_P = \frac{P_m - P_\infty}{q_\infty} \tag{29}$$

VII CALCULATION OF INLET VELOCITIES

$$V_i = M_i \left[\frac{\gamma g R T_{SC}}{1 + \frac{\gamma-1}{2} M_i^2}\right]^{0.5} \tag{30}$$

APPENDIX V11

(CONTD)

WHERE $$M_i = \left[\frac{(P_{Si}/P_{t_1})^{-\frac{\gamma-1}{\gamma}} - 1}{\frac{\gamma-1}{2}} \right]^{0.5}$$

$$V_{AVE} = \sum_i \frac{V_i}{IC} \qquad (31)$$

VIII REDUCTION OF TRAVERSING PROBE DATA

$$M_r = \frac{P_1 - P_2}{P_1} \qquad (32)$$

$$\theta_r = \frac{P_4 - P_5}{P_1 - P_2} \qquad (33)$$

$$P_S = P_1 - \bar{K}(P_1 - P_2) \qquad (34)$$

WHERE $\theta = f(M_r, \theta_r,$. FROM APP. II, FIG. II-6

AND $\bar{K} = f(M_r, \theta\ )$ FROM APP. II, FIG. II-7

$$M_{TP} = \left[\frac{(P_S/P_1)^{-\frac{\gamma-1}{\gamma}} - 1}{\frac{\gamma-1}{2}} \right]^{0.5} \qquad (35)$$

$$V_{TP} = M_{TP} \left[\frac{\gamma g R T_{SC}}{1 + \frac{\gamma-1}{2} M_{TP}^2} \right]^{0.5} \qquad (36)$$

$$V' = V_{TP} \cos\theta \cos Z \qquad (37)$$

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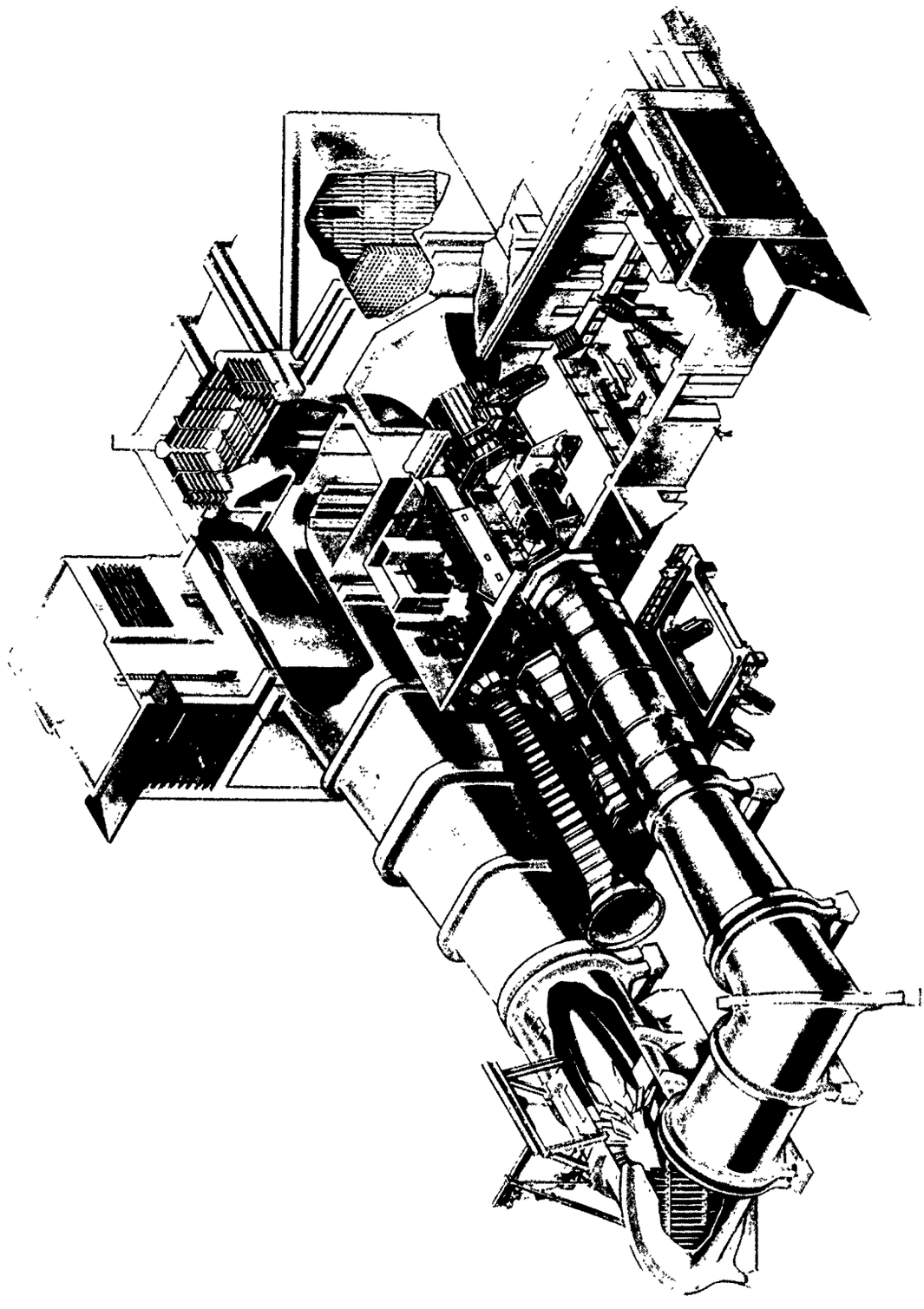
FIG. 1



HS VG SHROUDED PROPELLER TEST
UARL LARGE SUBSONIC WIND TUNNEL

RDT 5875

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HS VG SHROUDED PROPELLER TEST

SCHEMATIC DRAWING OF PROPELLER DYNAMOMETER

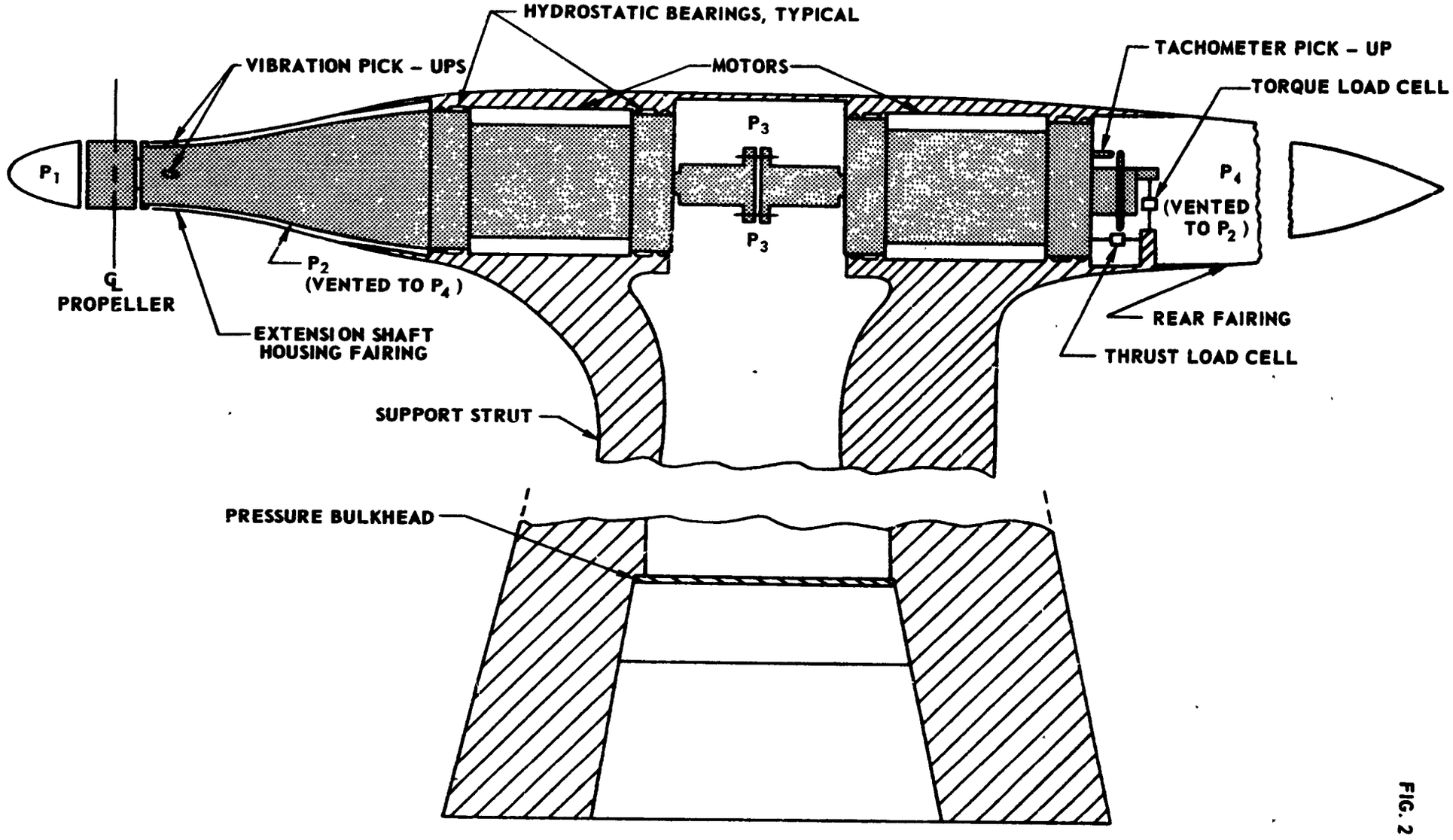
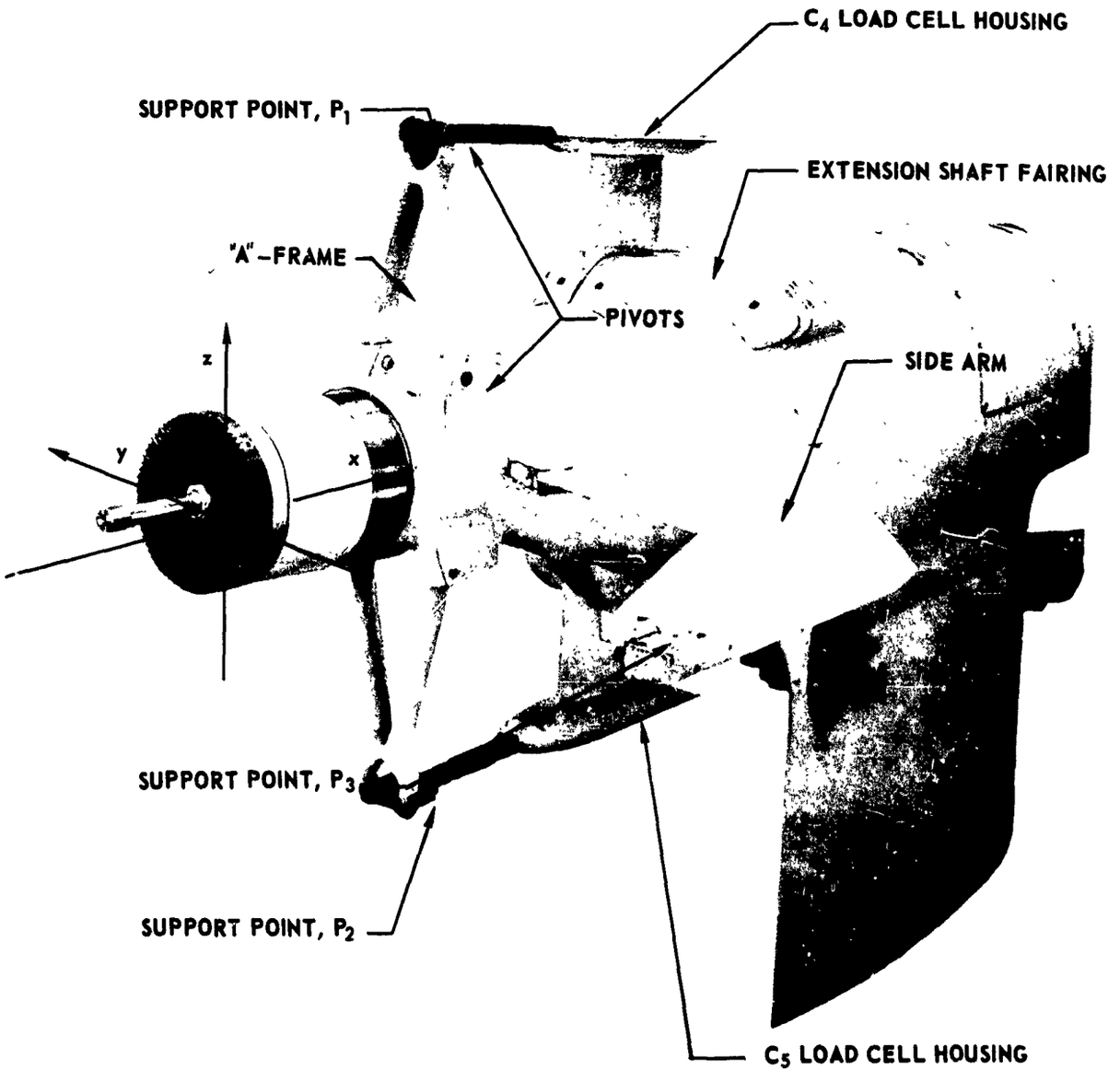


FIG. 2

HS VG SHROUDED PROPELLER TEST

SHROUD BALANCE SYSTEM

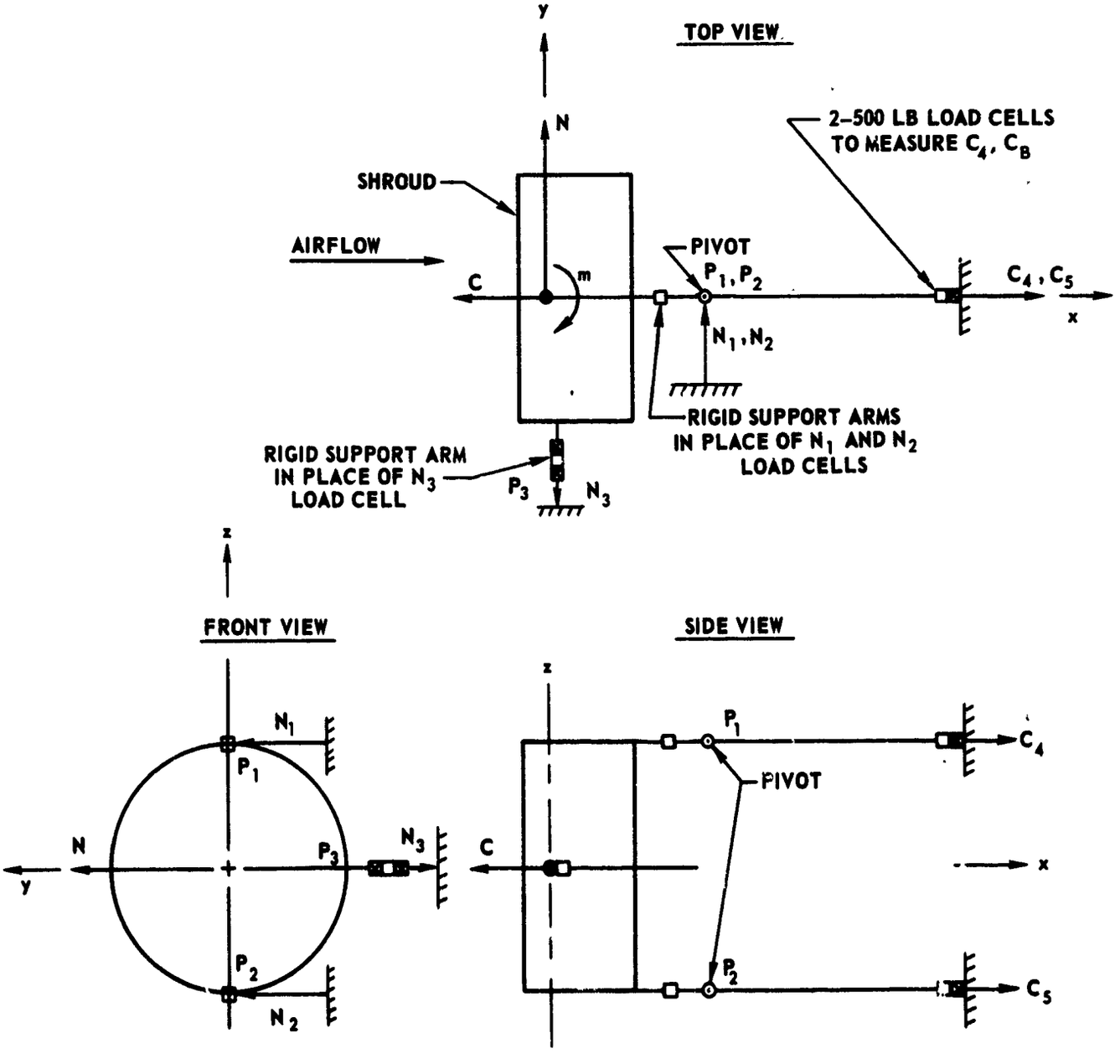


HS VG SHROUDED PROPELLER TEST

SCHEMATIC DIAGRAM OF SHROUD BALANCE

$$N = N_3 - N_1 - N_2$$

$$C = C_4 + C_5$$



HS VG SHROUDED PROPELLER TEST

MODEL PROPELLER TEST DYNAMOMETER INSTALLED IN 8-FT TEST SECTION

VIEW LOOKING DOWNSTREAM

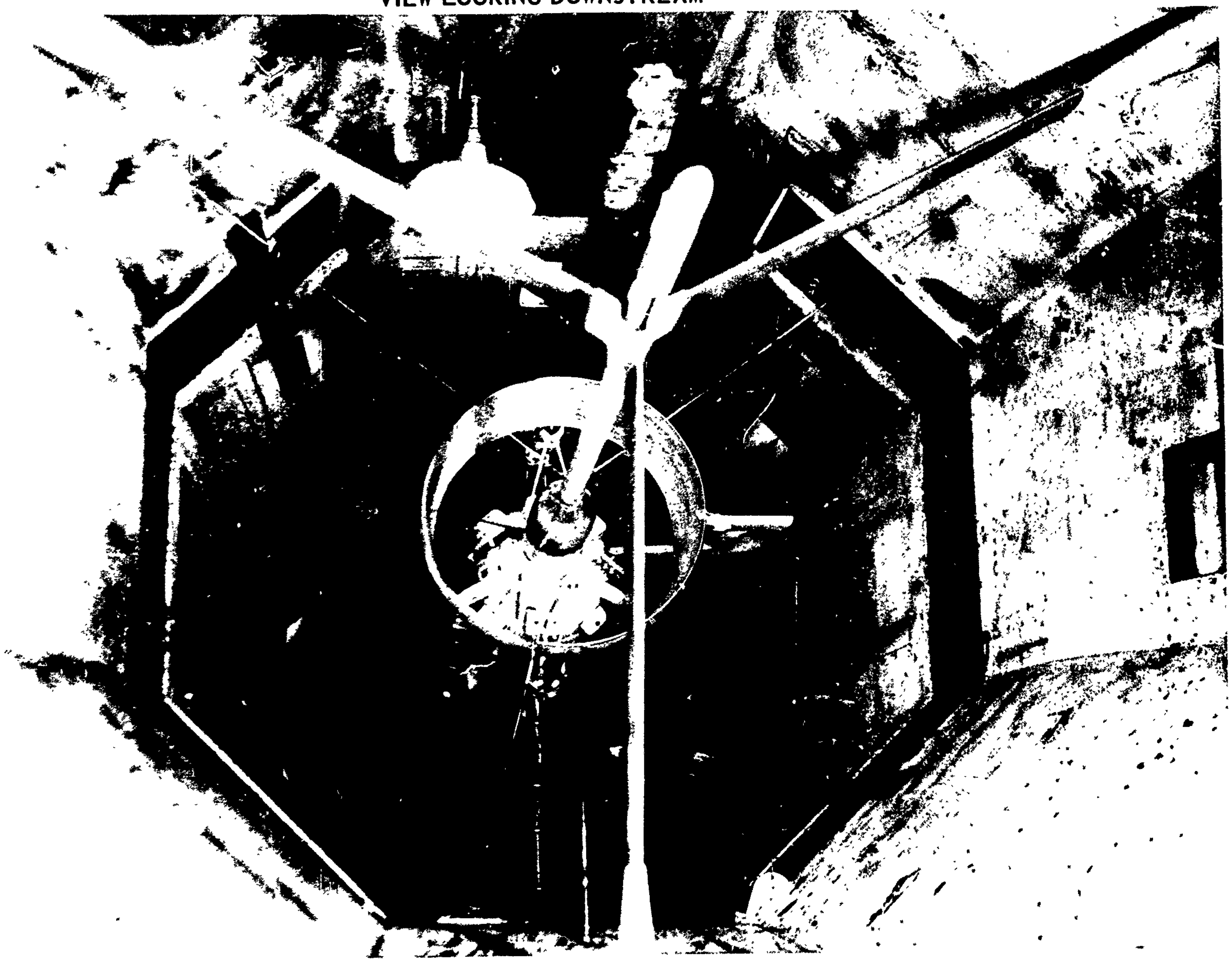


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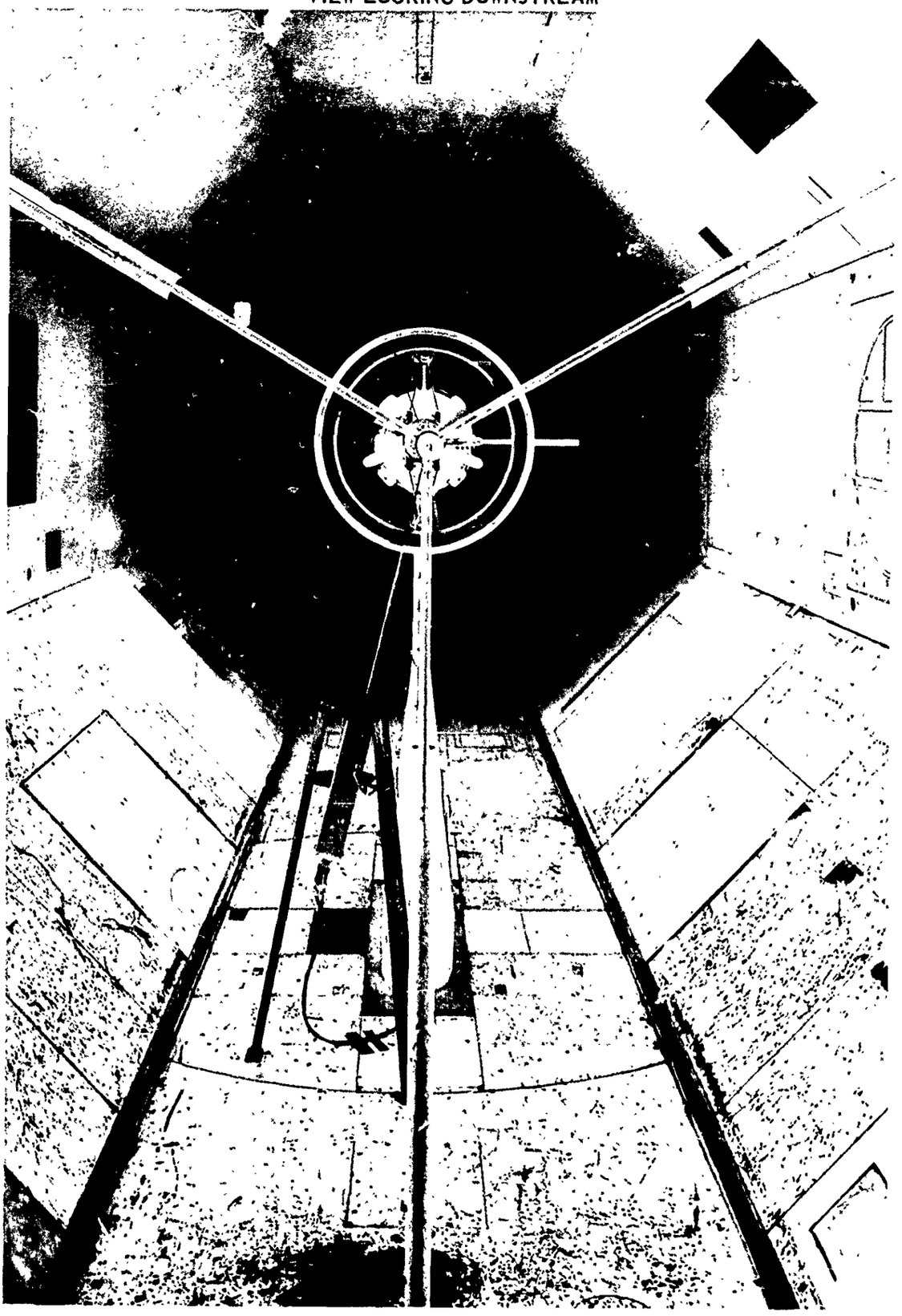
FIG. 6

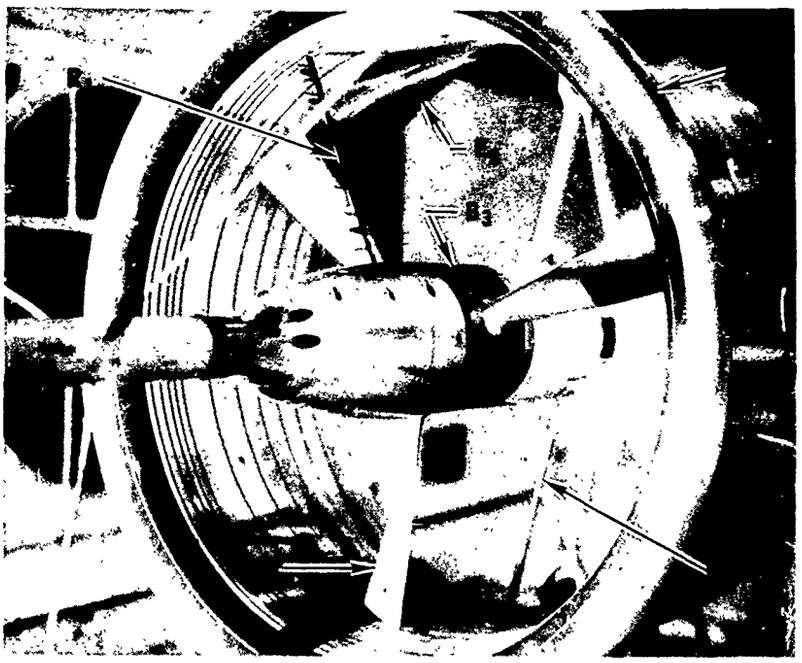
HS VG SHROUDED PROPELLER TEST

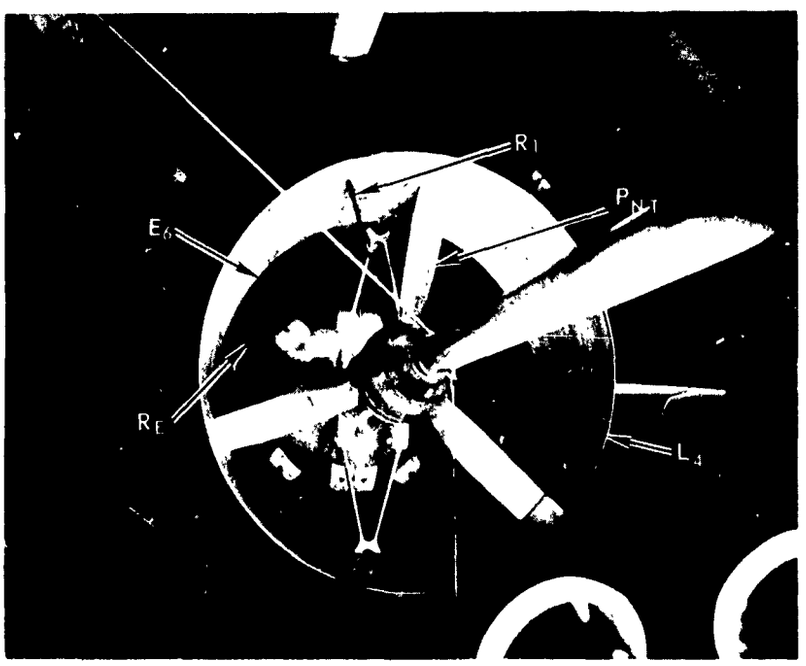
MODEL PROPELLER TEST DYNAMOMETER INSTALLED IN 18-FT TEST SECTION

VIEW LOOKING DOWNSTREAM



HS VG SHROUDED PROPELLER TEST
MODEL COMPONENT DESIGNATION SYMBOLS

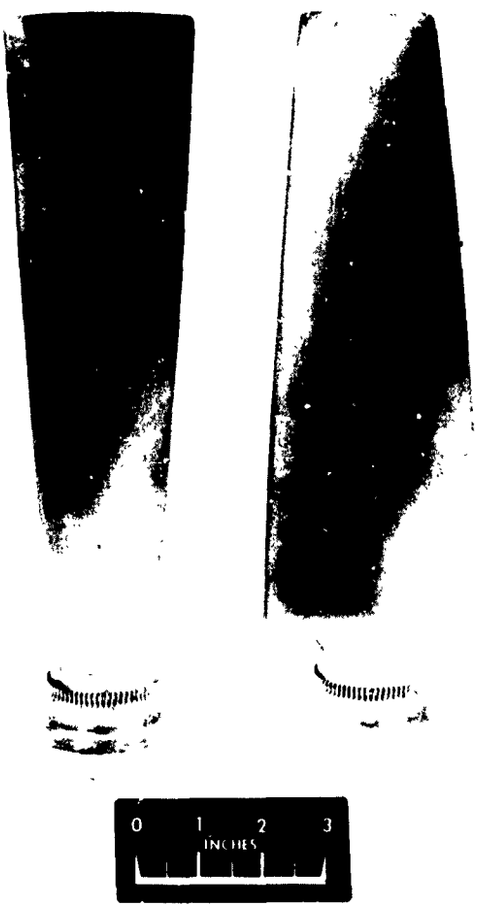




HS VG SHROUDED PROPELLER TEST
PROPELLER TEST BLADES

3-WAY
WIDE TIP, P_{WT}

3-WAY
NARROW TIP, P_{NT}



HS VG SHROUDED PROPELLER TEST

COMPARISON OF DATA REPEATABILITY IN THE 18-FT TEST SECTION

SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
○	8	0.05	$L_5 C_1 E_8 B_3 P_{WT} T_1 R_1 R_E$	29.0
△	21	↓	↓	↓

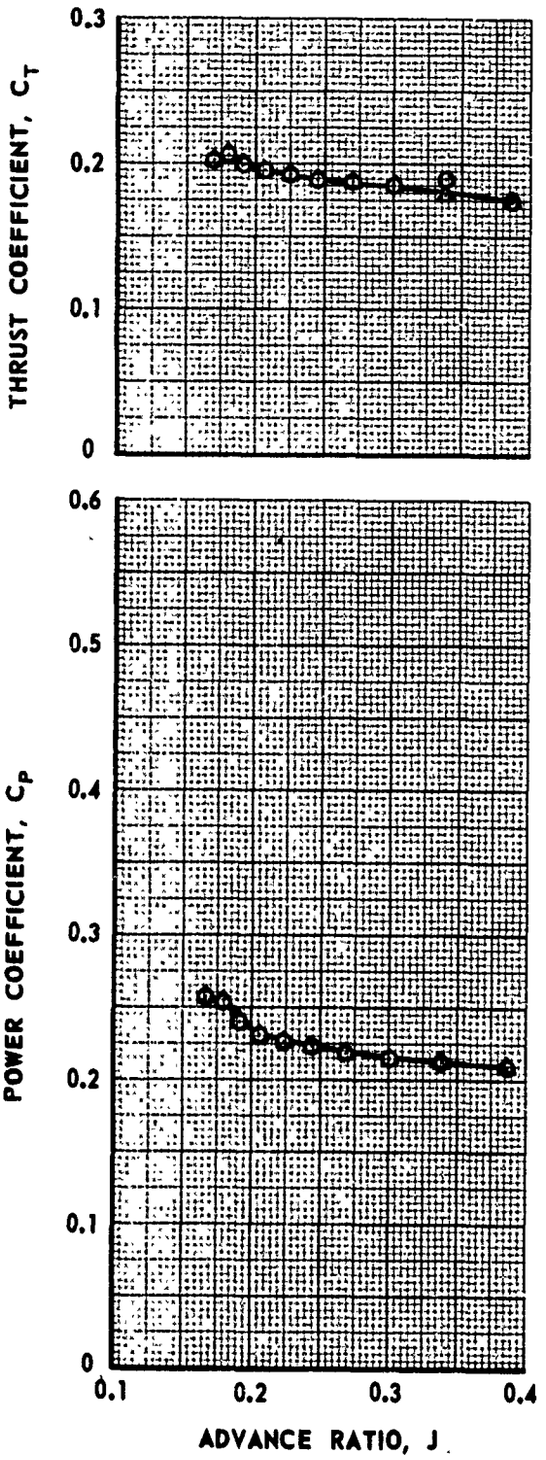


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FIG. 10

HS VG SHROUDED PROPELLER TEST
COMPARISON OF DATA REPEATABILITY IN THE 18-FT TEST SECTION

SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	8	0.05	$L_5 C_1 E_8 B_3 P_{WT} T_i R_1 R_E$	29.0
△	21	↓	↓	↓

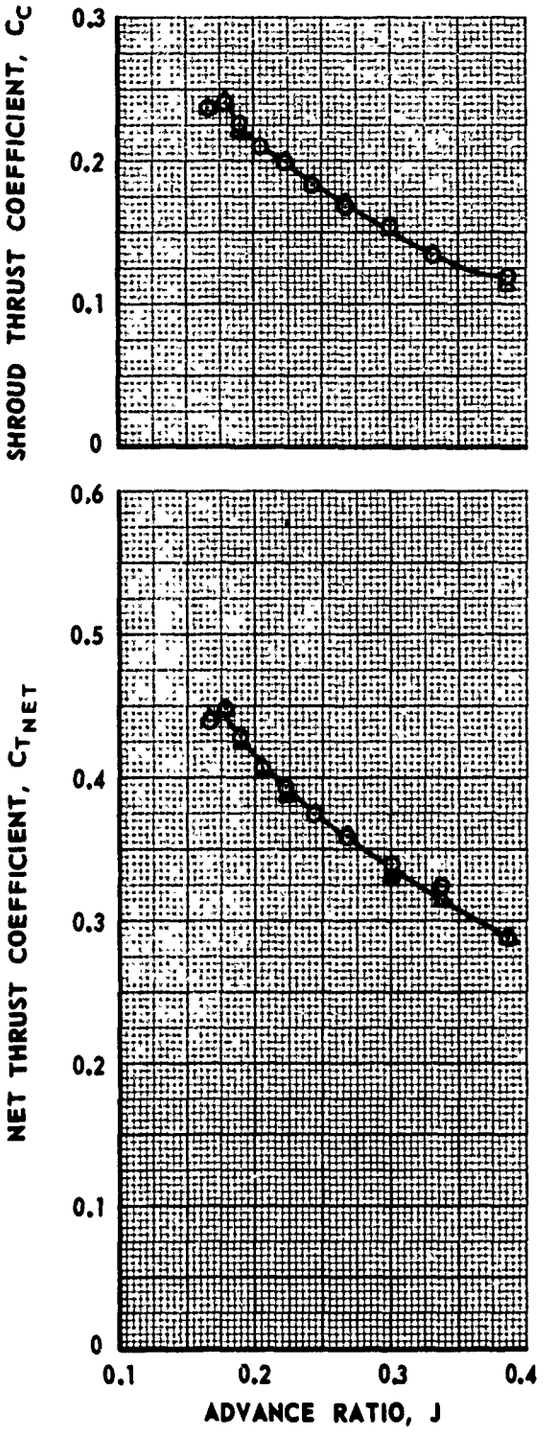

FIG. 11

HS VG SHROUDED PROPELLER TEST
COMPARISON OF DATA REPEATABILITY IN THE 8-FT TEST SECTION

SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	35	0.40	$L_4C_1E_7B_3P_{WT}T_1R_1R_E$	50.0
△	36	↓	↓	↓

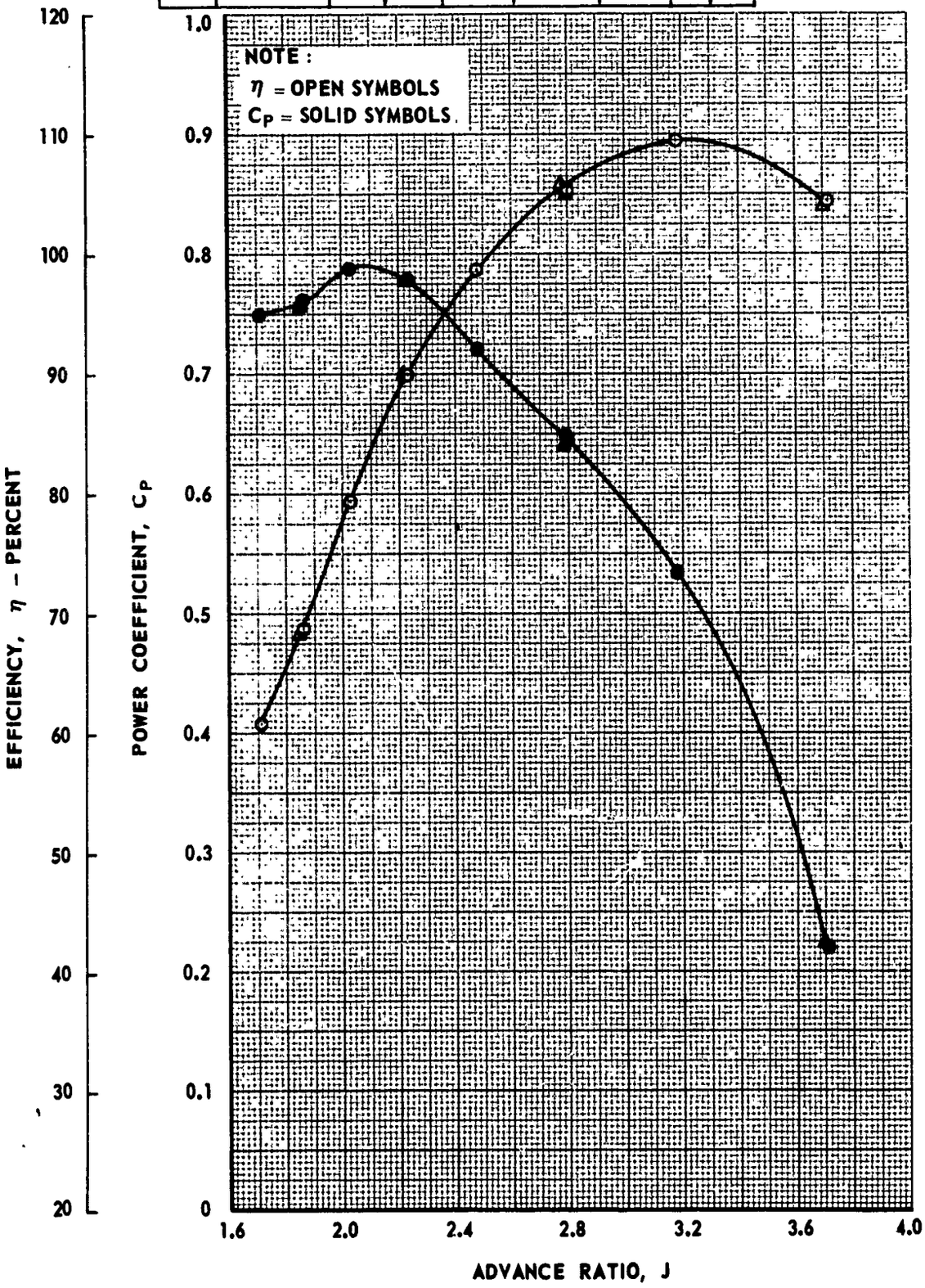

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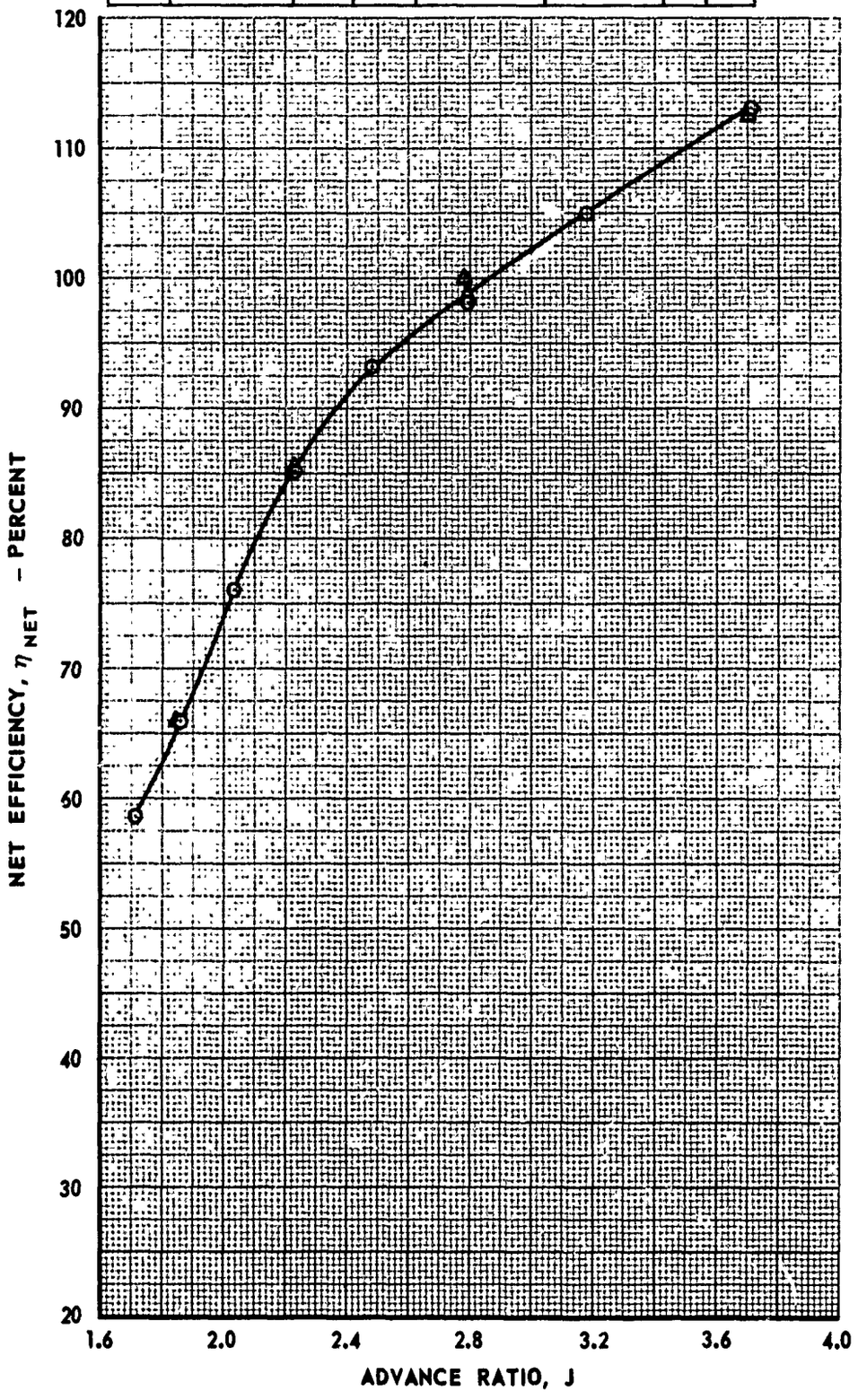
FIG. 12

HS VG SHROUDED PROPELLER TEST

COMPARISON OF DATA REPEATABILITY IN THE 8-FT TEST SECTION

SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	35	0.40	$L_4 C_1 E_7 B_3 P_{WT} T_1 R_1 R_E$	50.0
△	36	↓	↓	↓



HS VG SHROUDED PROPELLER TEST
COMPARISON OF DATA REPEATABILITY IN THE 8-FT TEST SECTION

SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	40	0.20	$L_4 C_1 E_7 B_3 P_{NT} T_2 R_1 R_E$	30.0
△	48			
⊡	62		$L_4 C_1 E_6 B_3 P_{NT} T_2 R_1 R_E$	28.0
◇	71			

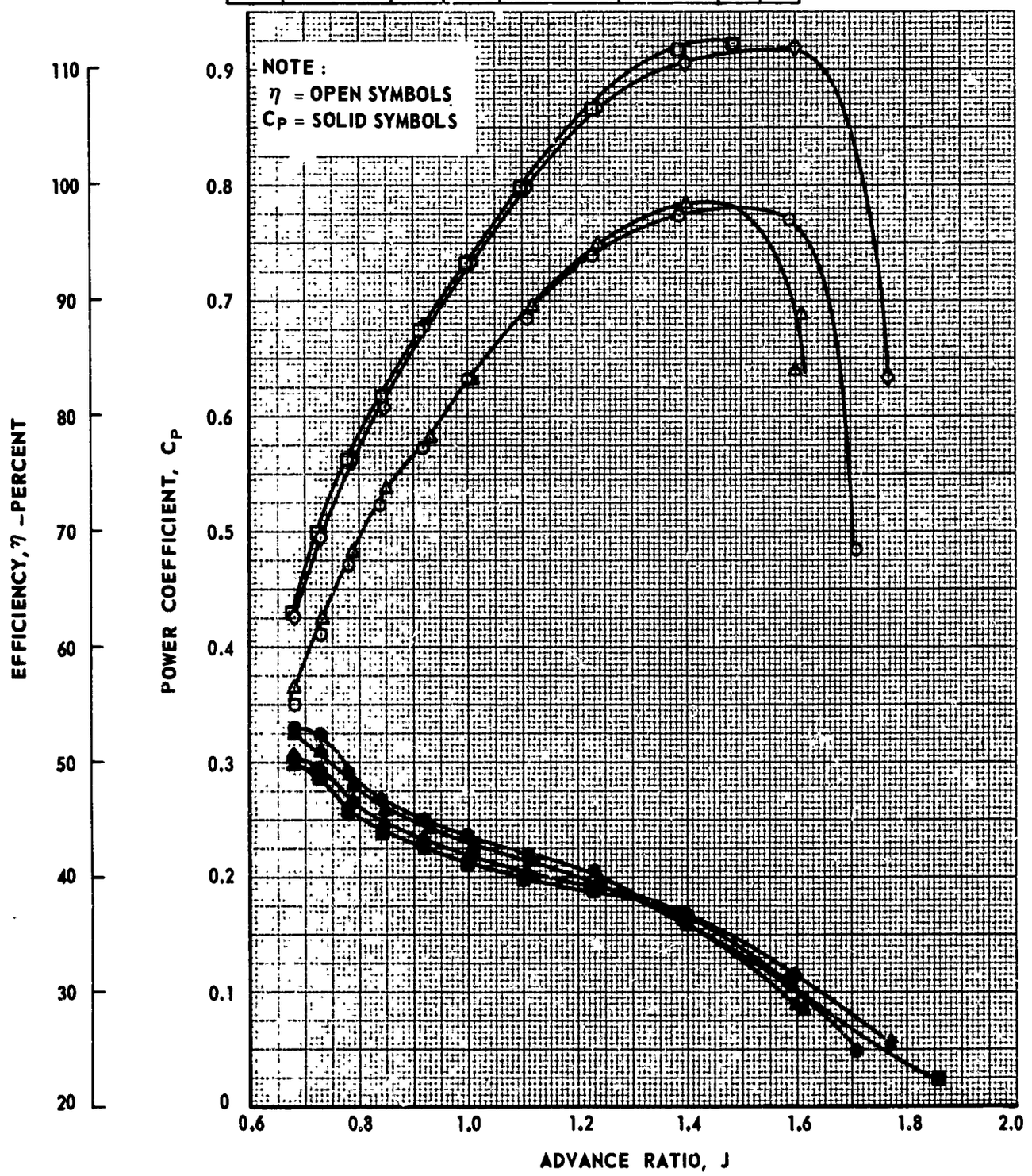
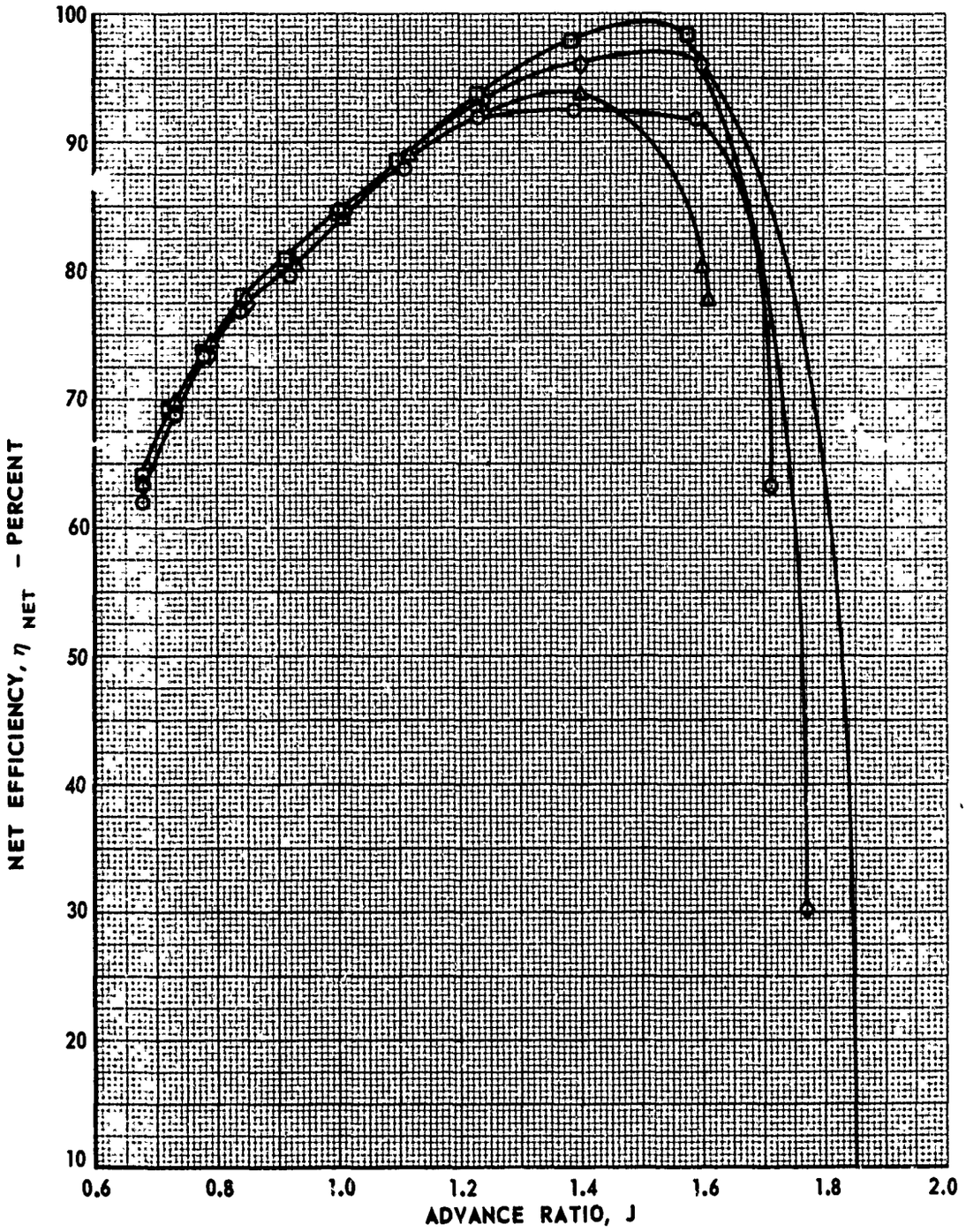


FIG. 14

HS VG SHROUDED PROPELLER TEST
COMPARISON OF DATA REPEATABILITY IN THE 8-FT TEST SECTION

SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	40	0.20	$L_4 C_1 E_7 B_3 P_{NT} T_2 R_1 R_E$	30.0
△	48			
⊡	62		$L_4 C_1 E_6 B_3 P_{NT} T_2 R_1 R_E$	28.0
◇	71			

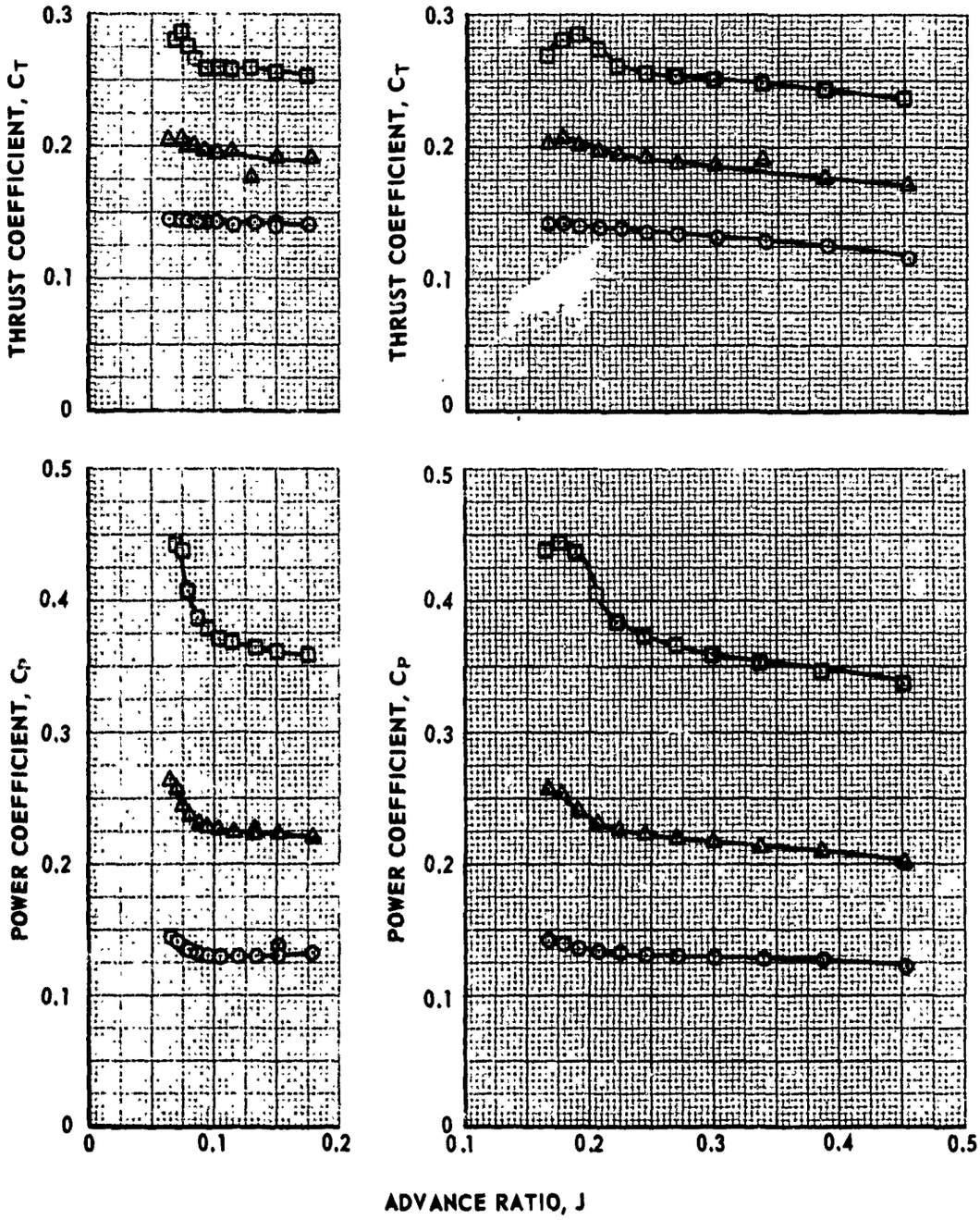


HS VG SHROUDED PROPELLER TEST

EFFECT OF BLADE ANGLE ON LOW SPEED SHROUDED PROPELLER PERFORMANCE

SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	4, 5	0.02, 0.05	$L_5C_1E_8B_3P_{WT}T_1R_1R_E$	22, 22
△	7, 8	↓	↓	29, 29
⊡	13, 12	↓	↓	36, 36

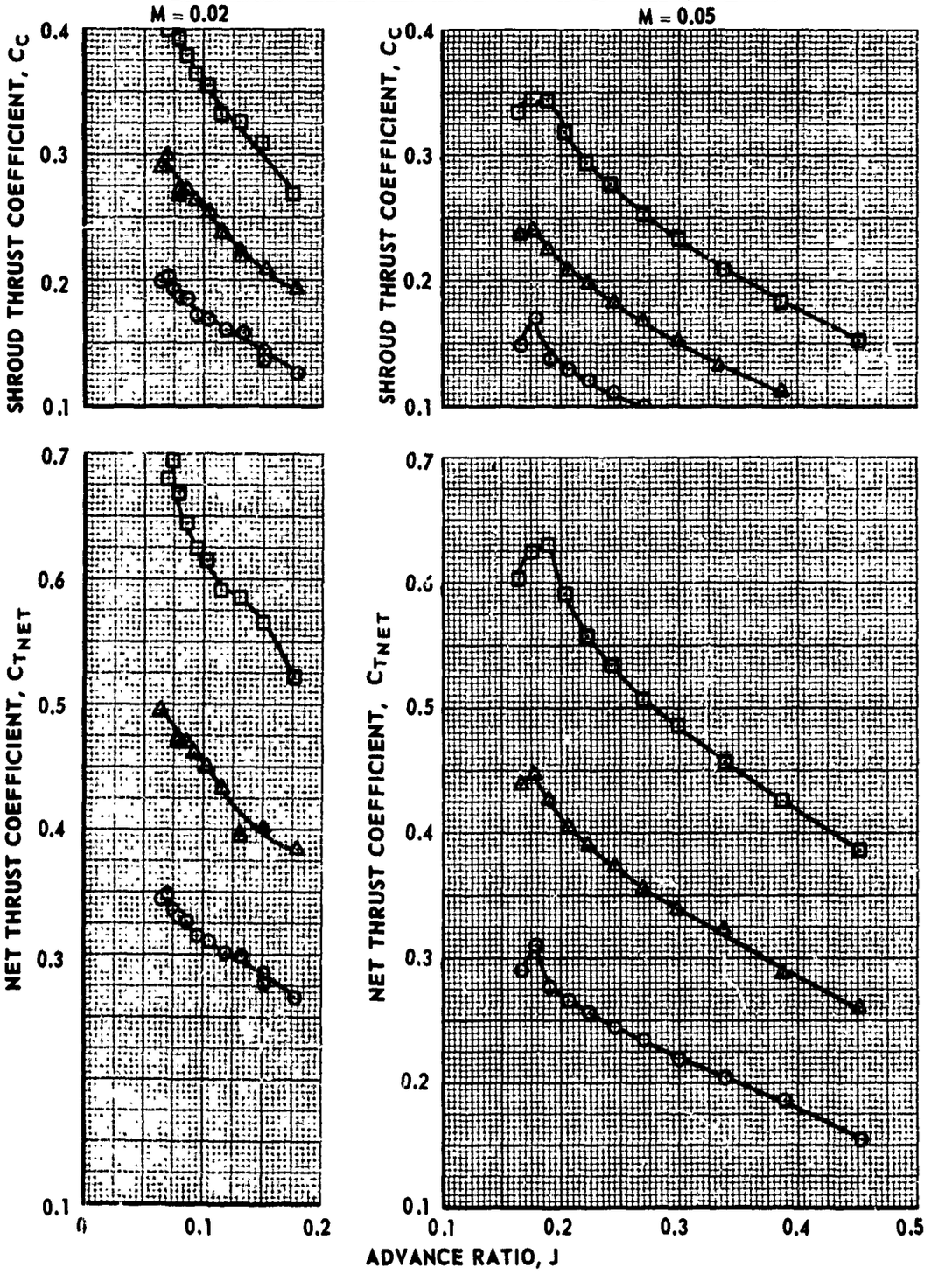
M = 0.02 M = 0.05



HS VG SHROUDED PROPELLER TEST

EFFECT OF BLADE ANGLE ON LOW SPEED SHROUDED PROPELLER PERFORMANCE

SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	4, 5	0.02, 0.05	$L_5C_1E_8B_3P_{WT}T_1R_1R_E$	22, 22
△	7, 8			29, 29
⊡	13, 12			36, 36



HS VG SHROUDED PROPELLER TEST

EFFECT OF BLADE ANGLE ON LOW SPEED SHROUDED PROPELLER PERFORMANCE

SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	6	0.10	$L_5 C_1 E_8 B_3 P_{WT} T_1 R_1 R_E$	22.0
△	9			29.0
⊡	11			36.0

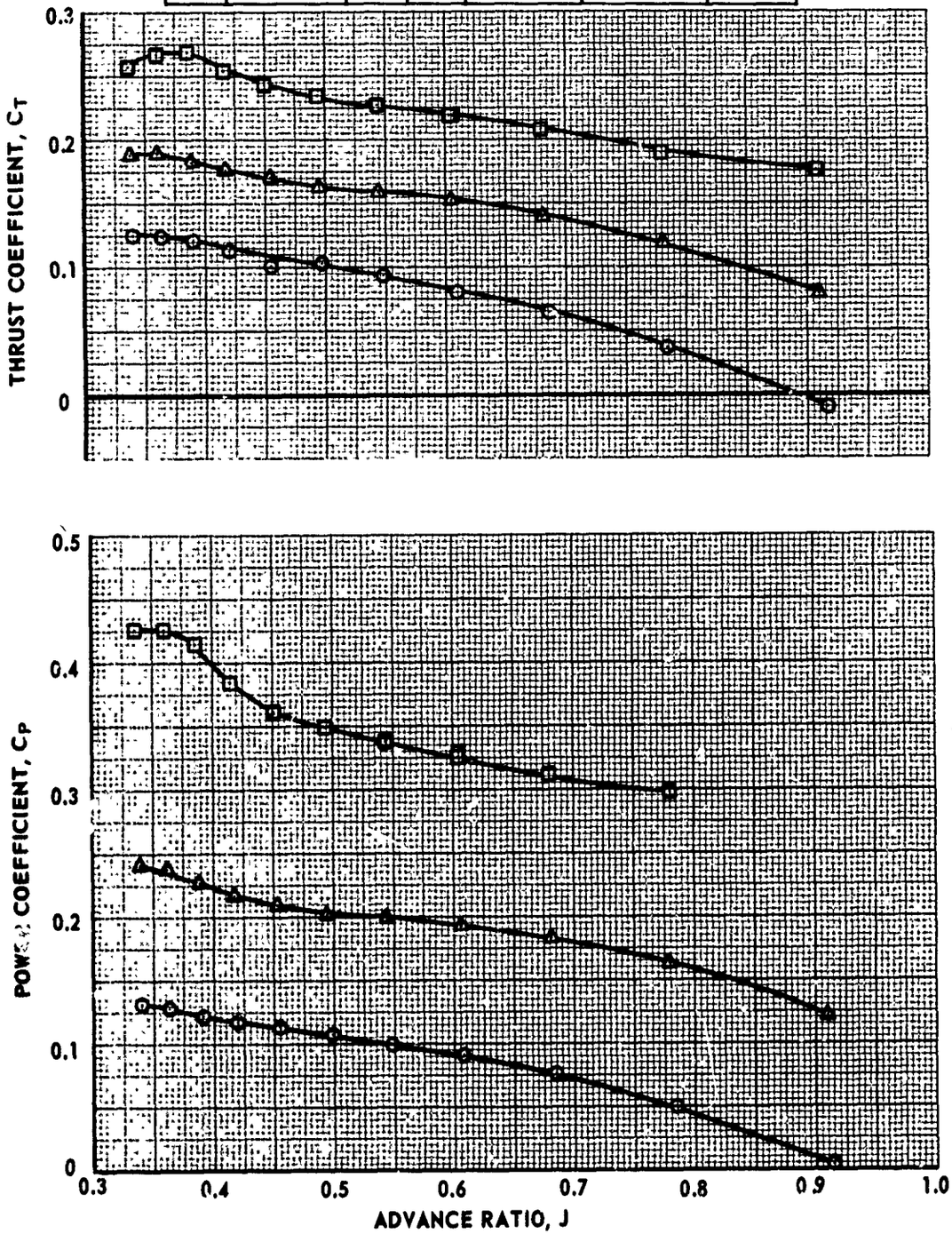


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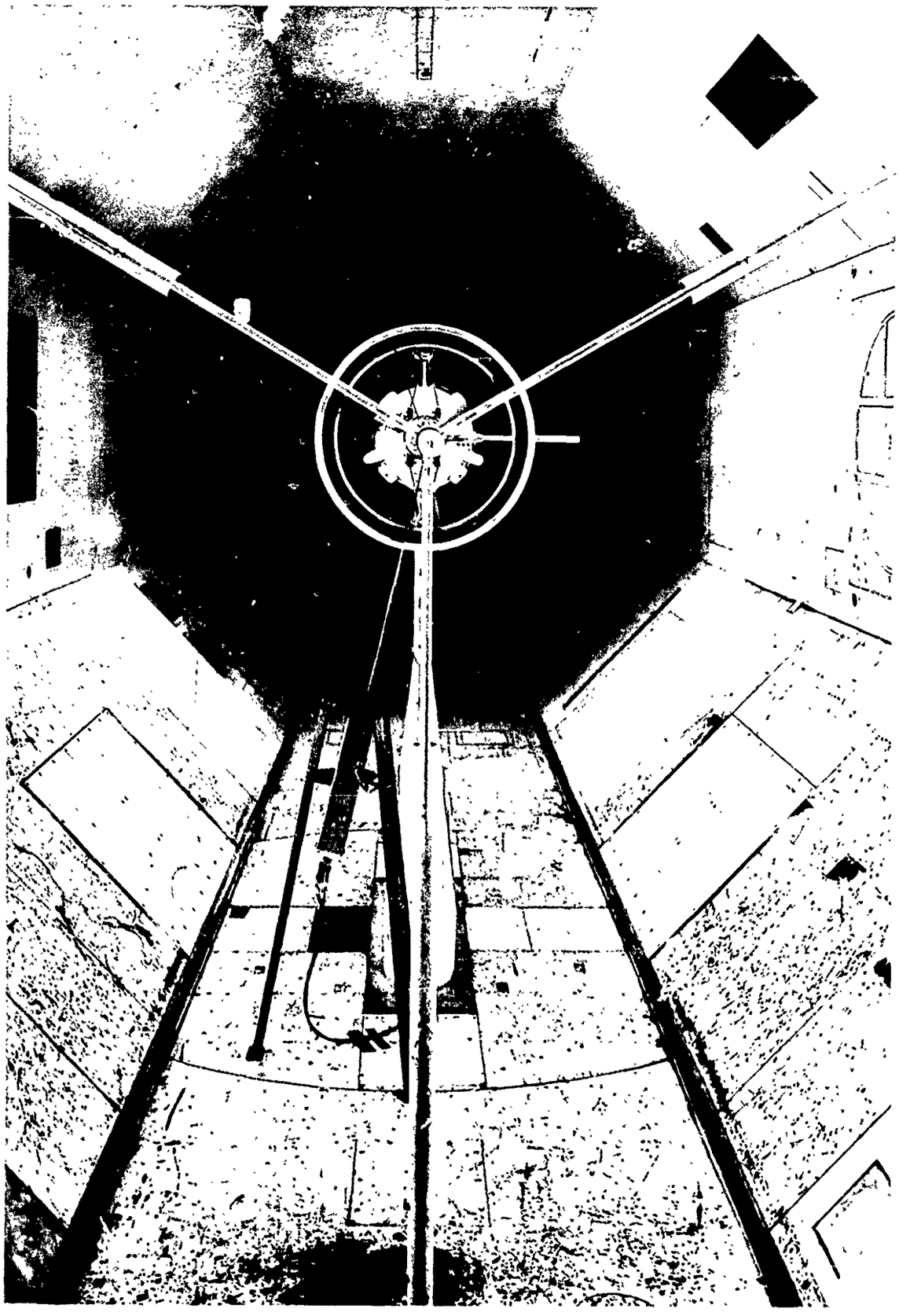
FIG. 6

HS VG SHROUDED PROPELLER TEST

MODEL PROPELLER TEST DYNAMOMETER INSTALLED IN 18-FT TEST SECTION

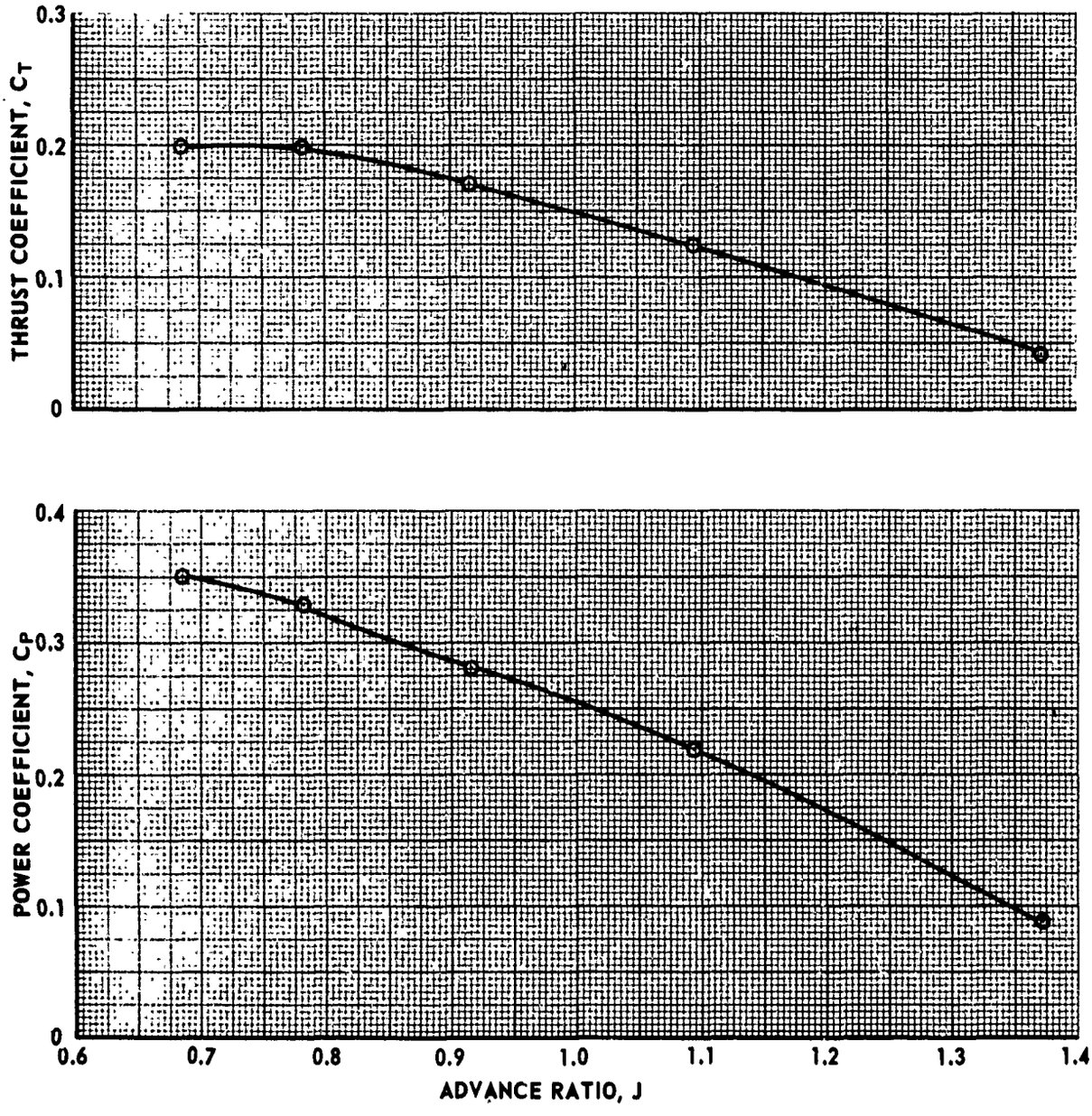
VIEW LOOKING DOWNSTREAM



HS VG SHROUDED PROPELLER TEST

EFFECT OF BLADE ANGLE ON LOW SPEED SHROUDED PROPELLER PERFORMANCE

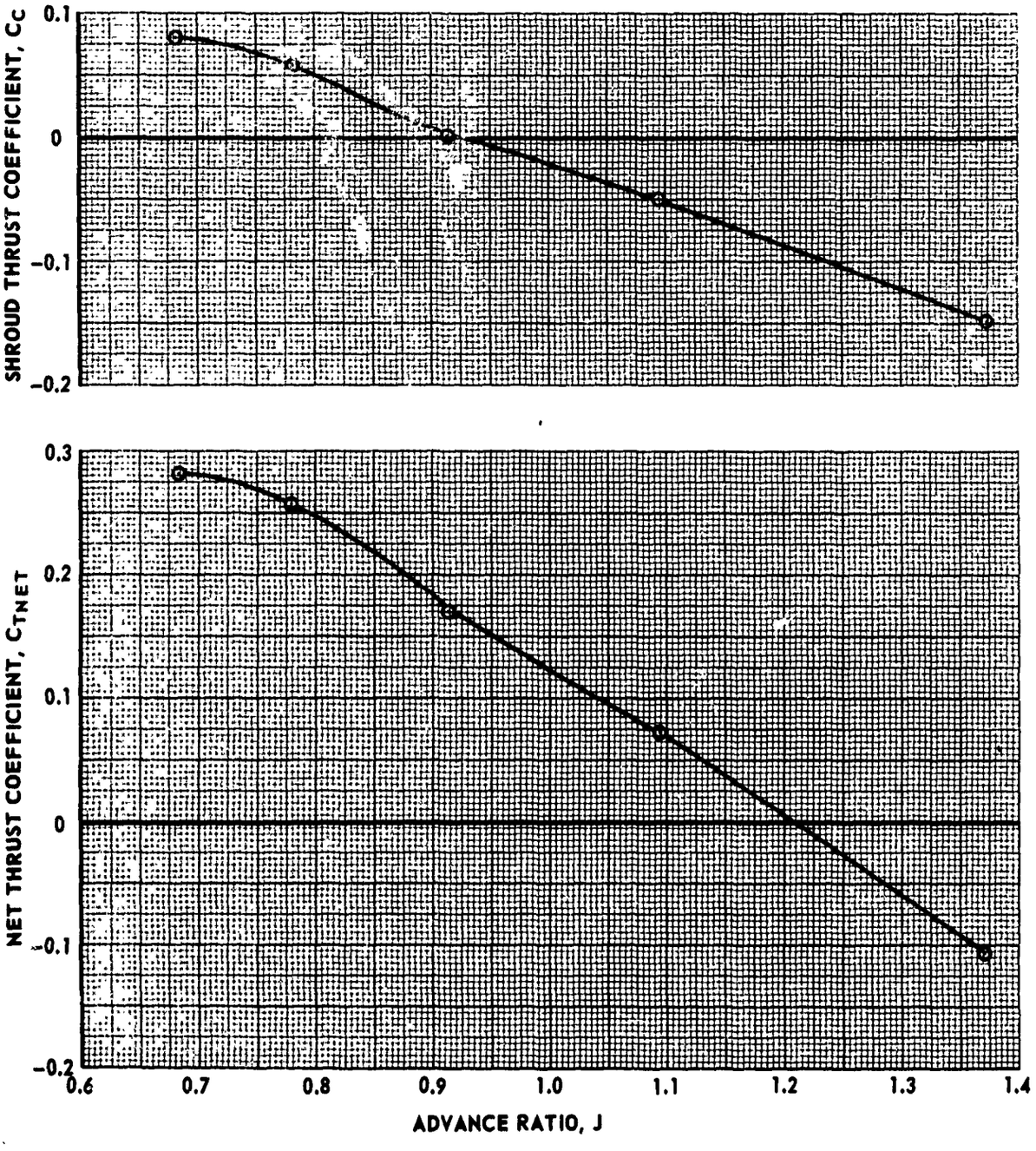
SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	14	0.20	$L_5 C_1 E_8 B_3 P_{WT} T_1 R_1 R_E$	36.0



HS VG SHROUDED PROPELLER TEST

EFFECT OF BLADE ANGLE ON LOW SPEED SHROUDED PROPELLER PERFORMANCE

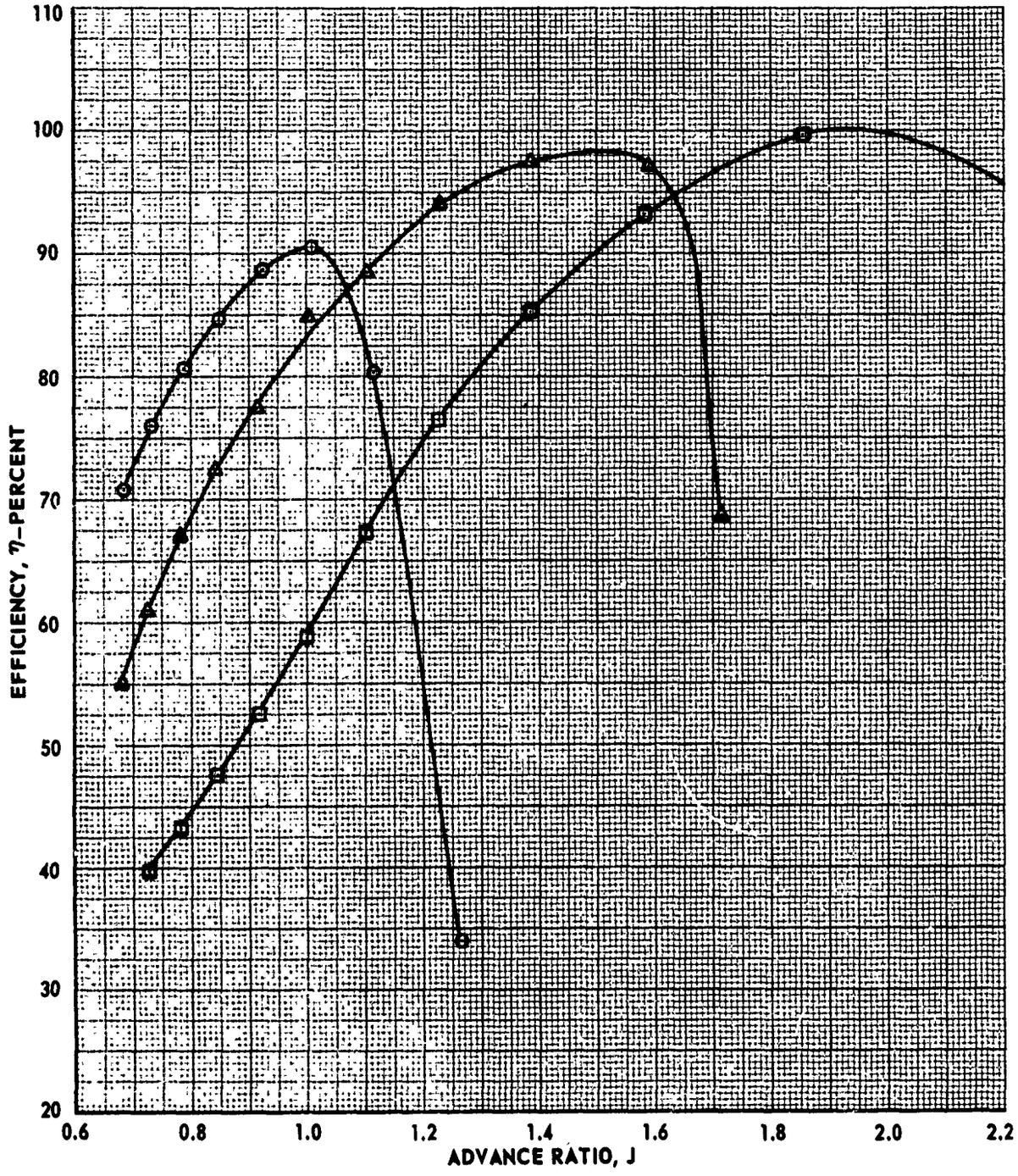
SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	14	0.20	$L_5 C_1 E_8 B_3 P_{WT} T_1 R_1 R_E$	36.0



HS VG SHROUDED PROPELLER TEST

EFFECT OF BLADE ANGLE ON HIGH SPEED SHROUDED PROPELLER PERFORMANCE

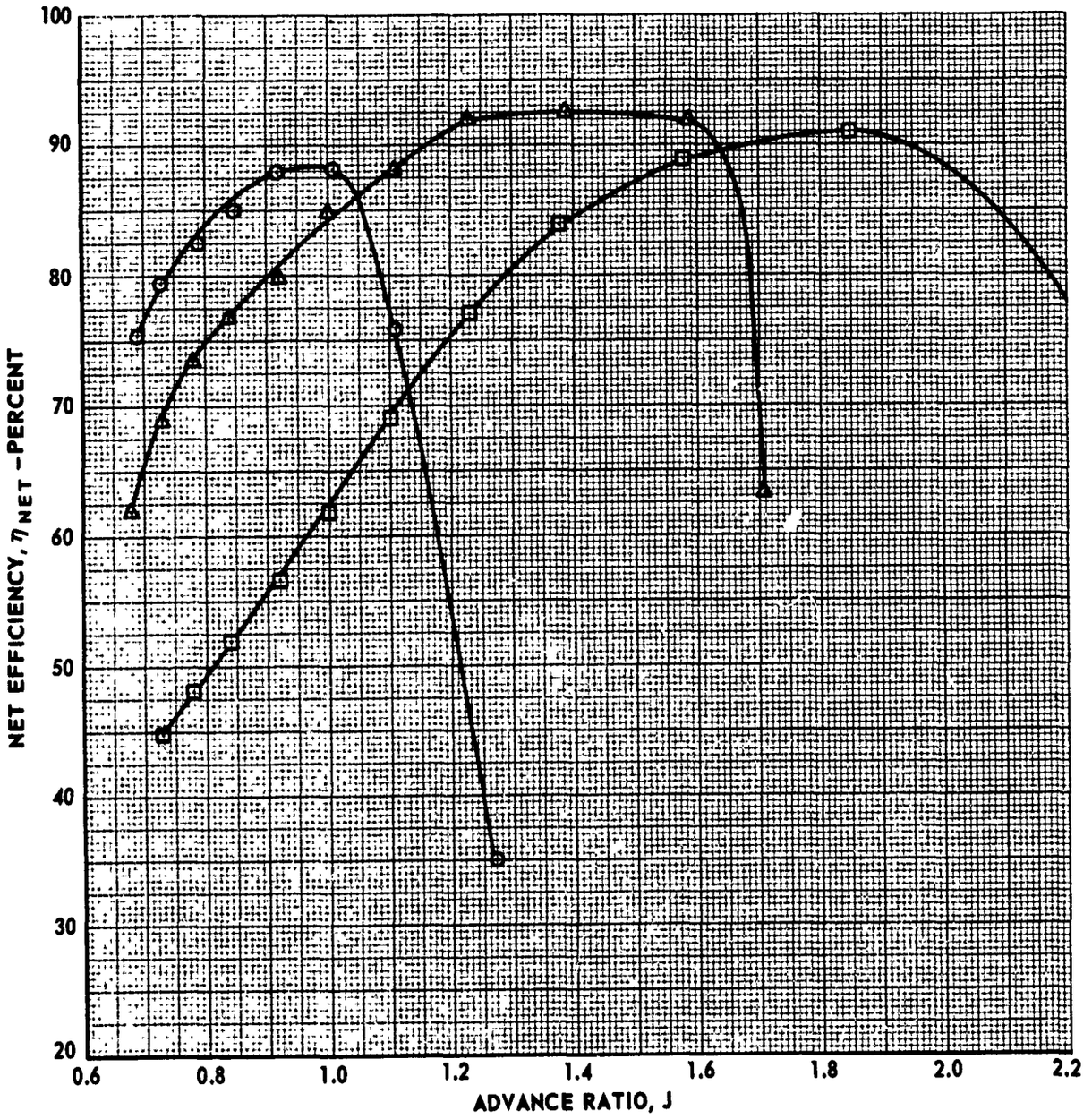
SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	39	0.20	$L_4 C_1 E_7 B_3 P_{NT} T_2 R_1 R_E$	22.0
△	40			30.0
⊡	42			40.0



HS VG SHROUDED PROPELLER TEST

EFFECT OF BLADE ANGLE ON HIGH SPEED SHROUDED PROPELLER PERFORMANCE

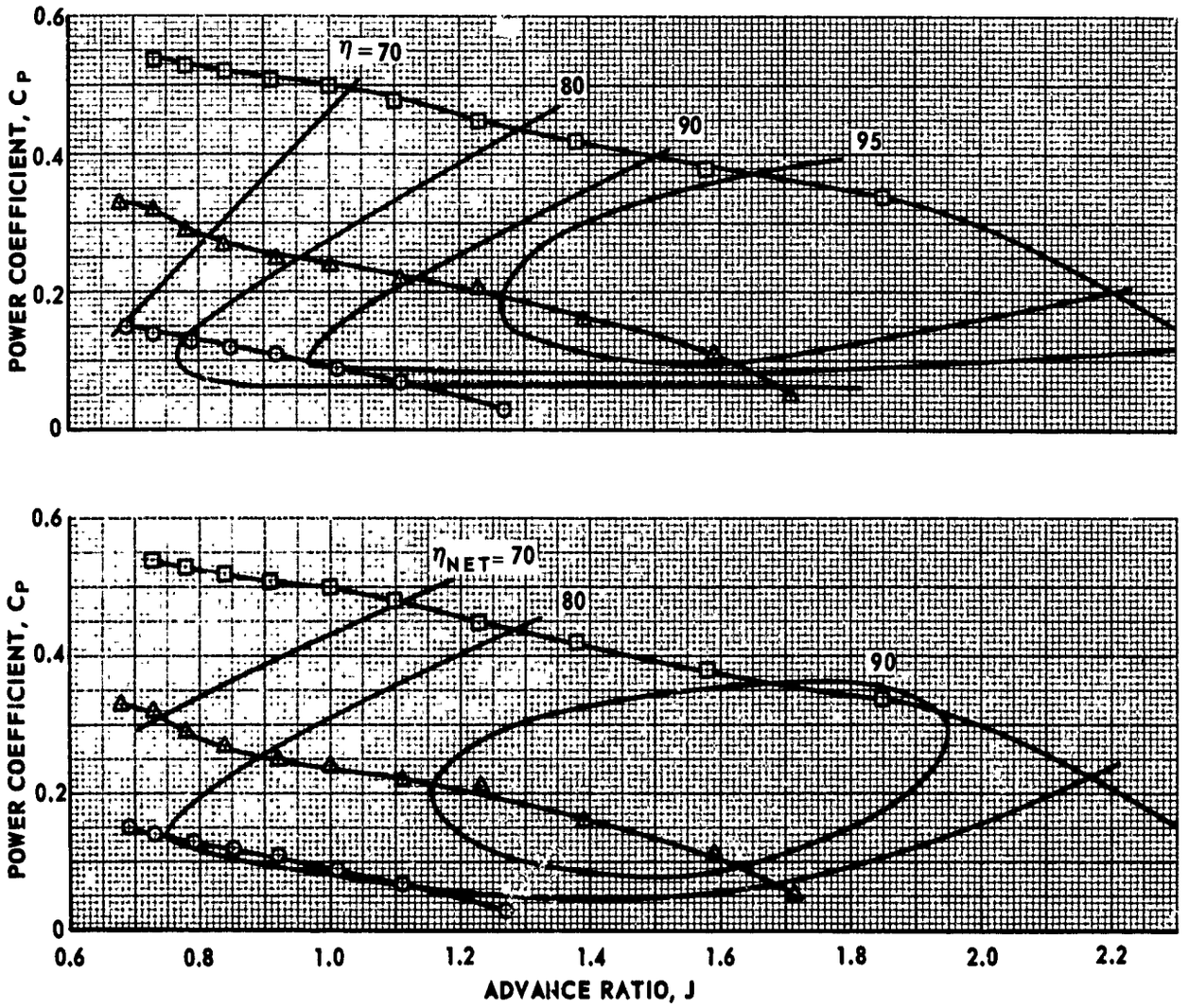
SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	39	0.20	$L_4 C_1 E_7 B_3 P_{NT} T_2 R_1 R_E$	22.0
△	40			30.0
⊡	42			40.0



HS VG SHROUDED PROPELLER TEST

EFFECT OF BLADE ANGLE ON HIGH SPEED SHROUDED PROPELLER PERFORMANCE

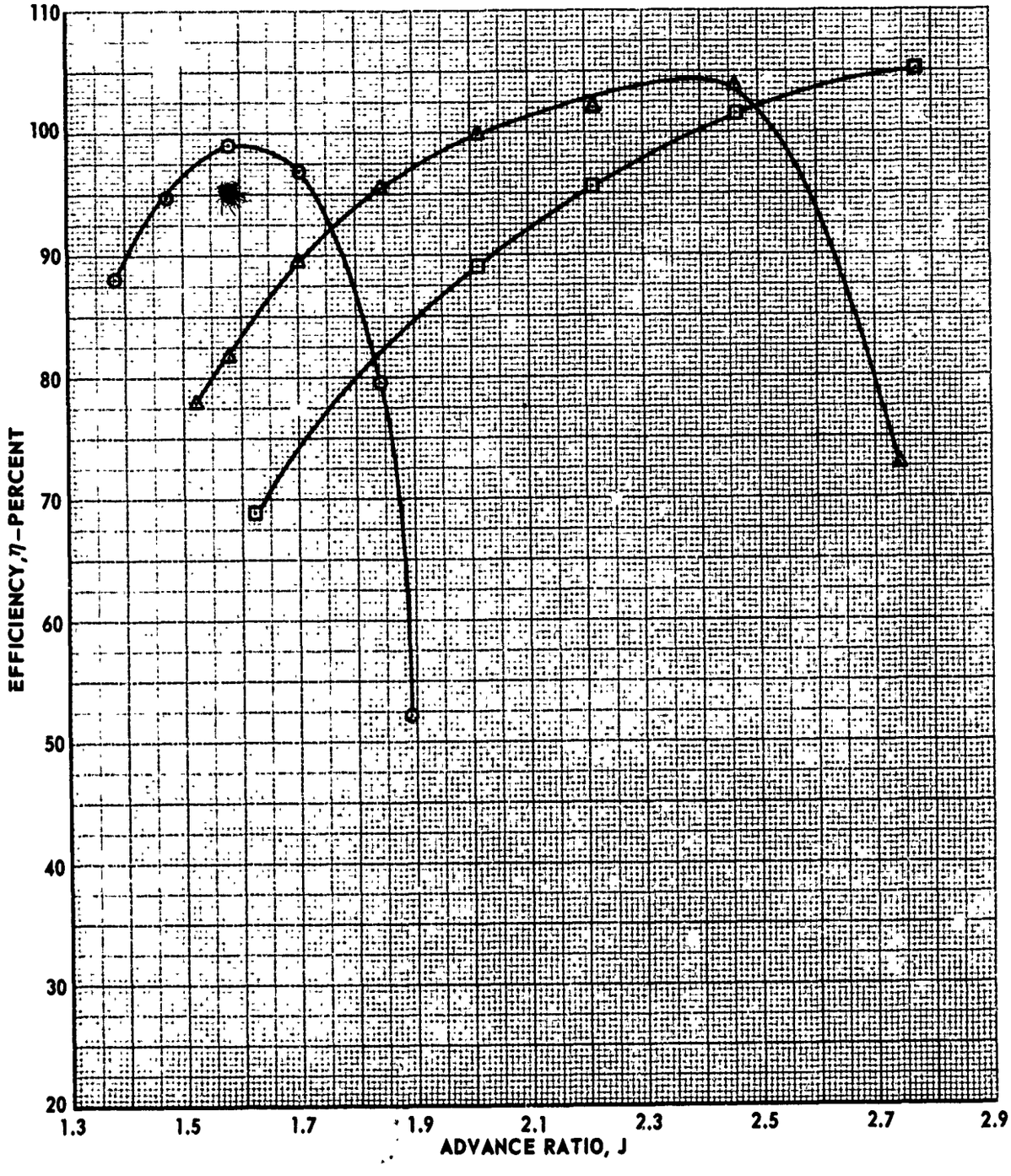
SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	39	0.20	$L_4 C_1 E_7 B_3 P_{NT} T_2 R_1 R_E$	22.0
△	40	↓	↓	30.0
⊡	42	↓	↓	40.0



HS VG SHROUDED PROPELLER TEST

EFFECT OF BLADE ANGLE ON HIGH SPEED SHROUDED PROPELLER PERFORMANCE

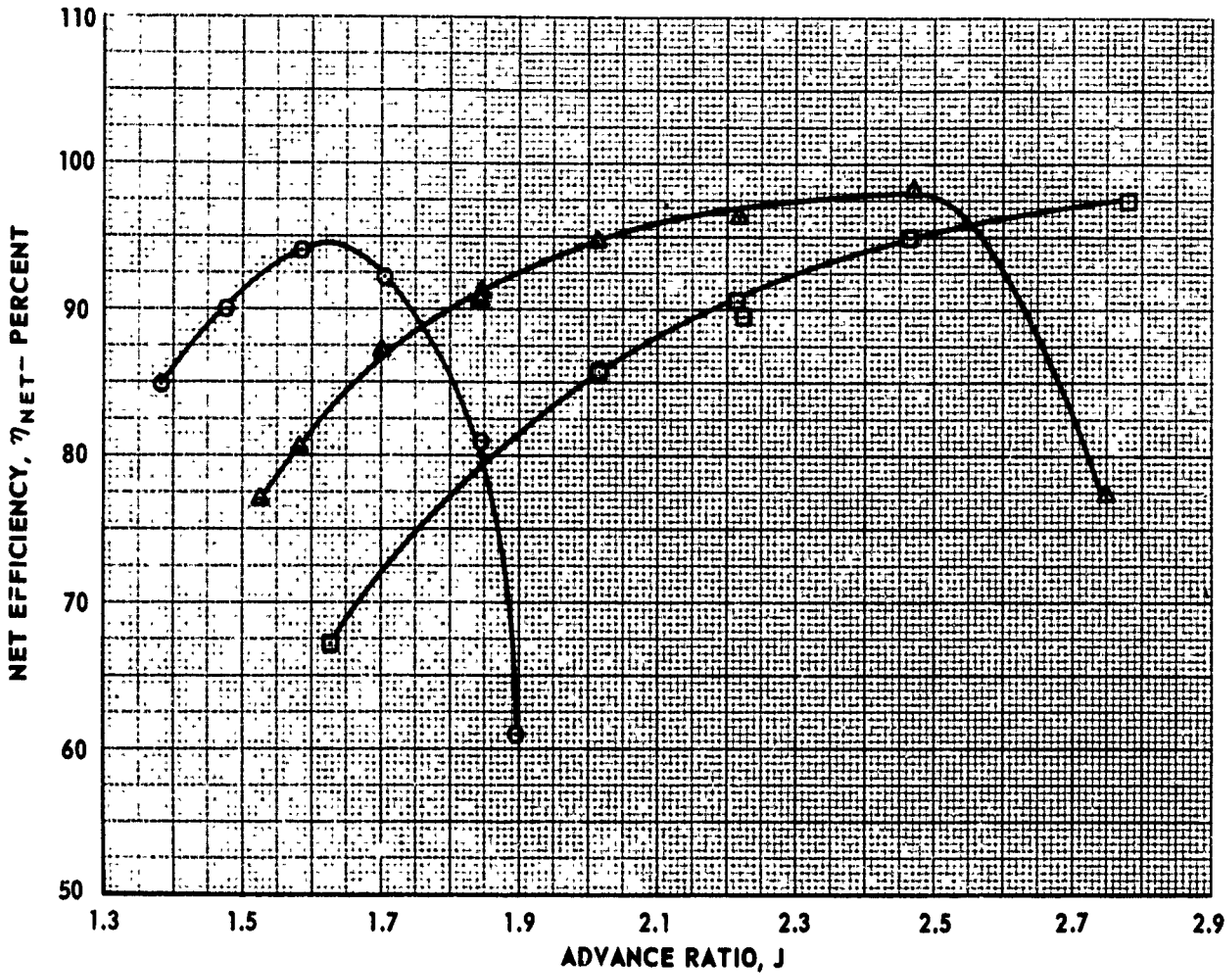
SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	41	0.40	$L_4 C_1 E_7 B_3 P_{NT} T_2 R_1 R_E$	32.0
△	43			43.0
⊡	45			49.0



HS VG SHROUDED PROPELLER TEST

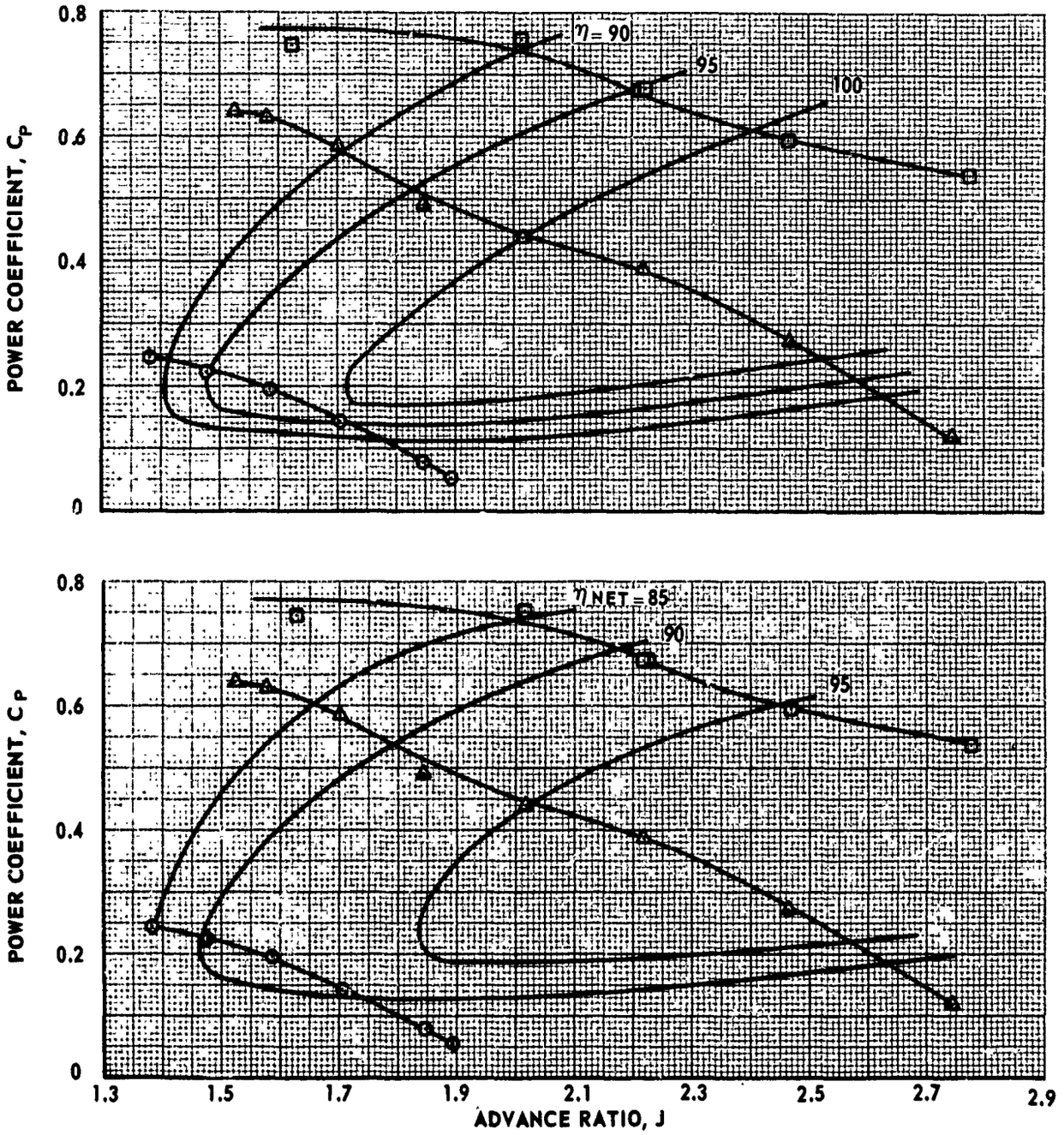
EFFECT OF BLADE ANGLE ON HIGH SPEED SHROUDED PROPELLER PERFORMANCE

SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	41	0.40	$L_4 C_1 E_7 B_3 P_{NT} T_2 R_1 R_E$	32.0
△	43	↓	↓	43.0
⊡	45	↓	↓	49.0



HS VG SHROUDED PROPELLER TEST
EFFECT OF BLADE ANGLE ON HIGH SPEED SHROUDED PROPELLER PERFORMANCE

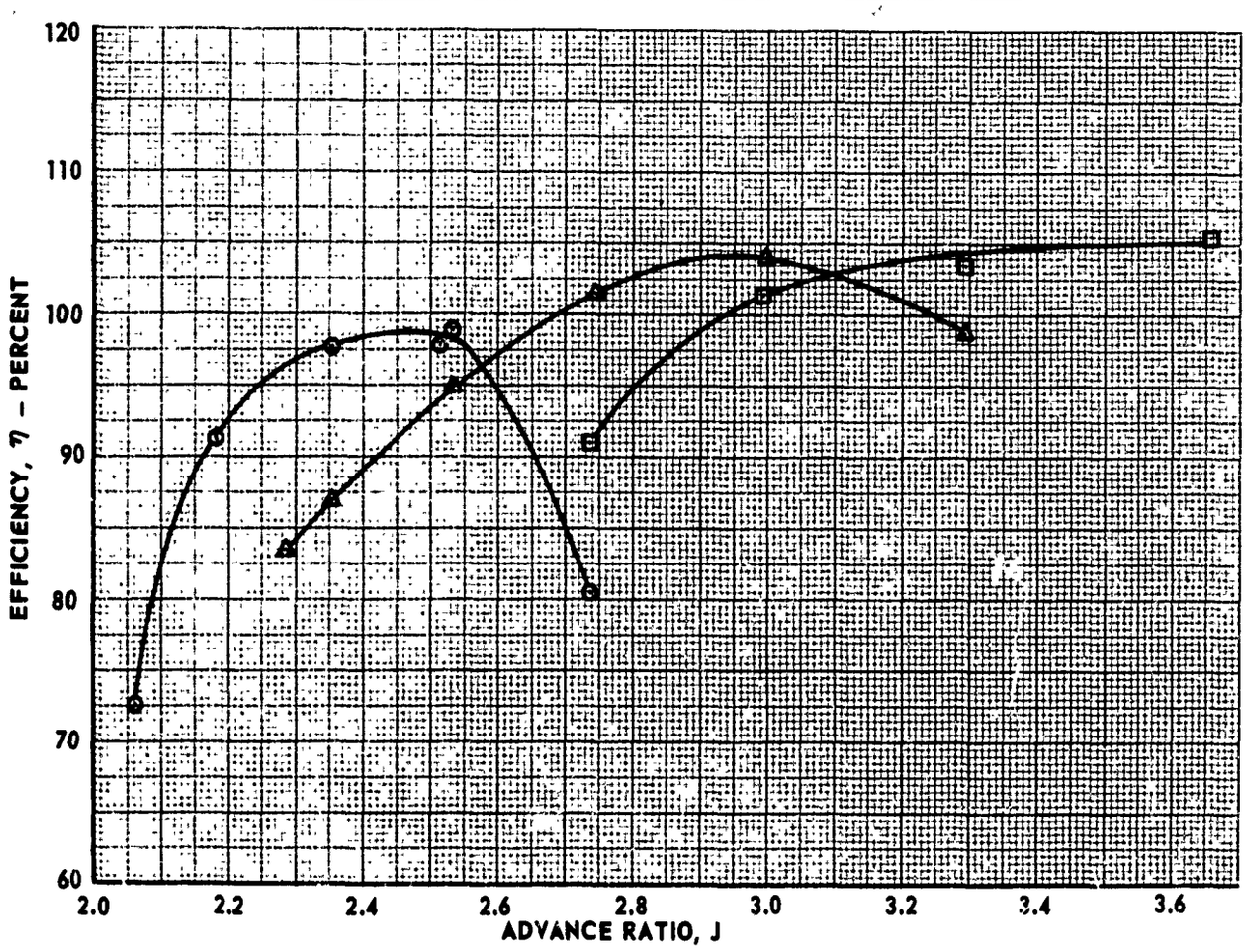
SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	41	0.40	$L_4 C_1 E_7 B_3 P_{NT} T_2 R_1 R_E$	32.0
△	43	↓	↓	43.0
⊡	45	↓	↓	49.0



HS VG SHROUDED PROPELLER TEST

EFFECT OF BLADE ANGLE ON HIGH SPEED SHROUDED PROPELLER PERFORMANCE

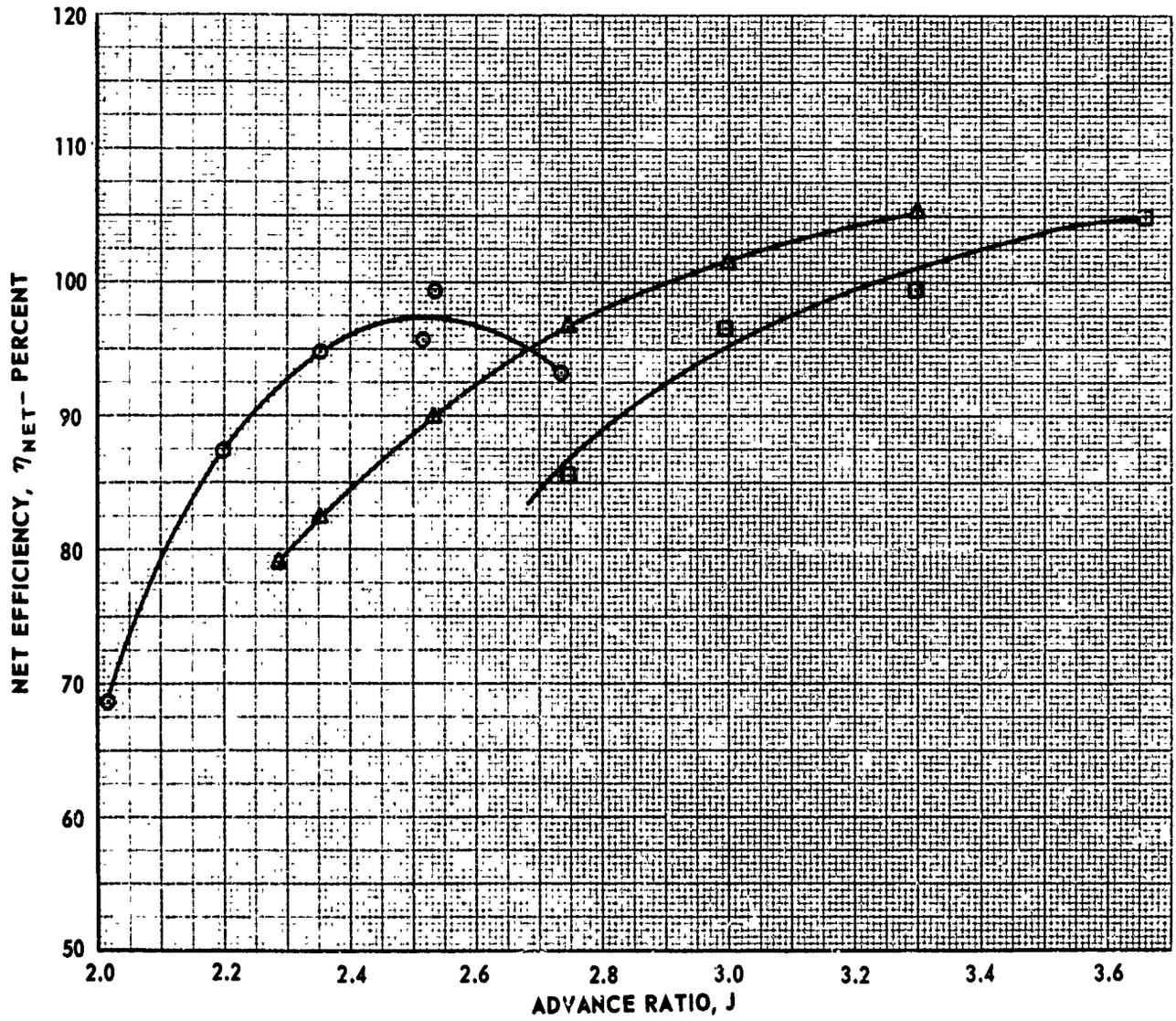
SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	44	0.60	$L_4 C_1 E_7 B_3 P_{NT} T_2 R_1 R_E$	43.0
△	46	↓	↓	49.0
□	47	↓	↓	54.0



HS VG SHROUDED PROPELLER TEST

EFFECT OF BLADE ANGLE ON HIGH SPEED SHROUDED PROPELLER PERFORMANCE

SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	44	0.60	$L_4 C_1 E_7 B_3 P_{NT} T_2 R_1 R_E$	43.0
△	46			49.0
⊡	47			54.0



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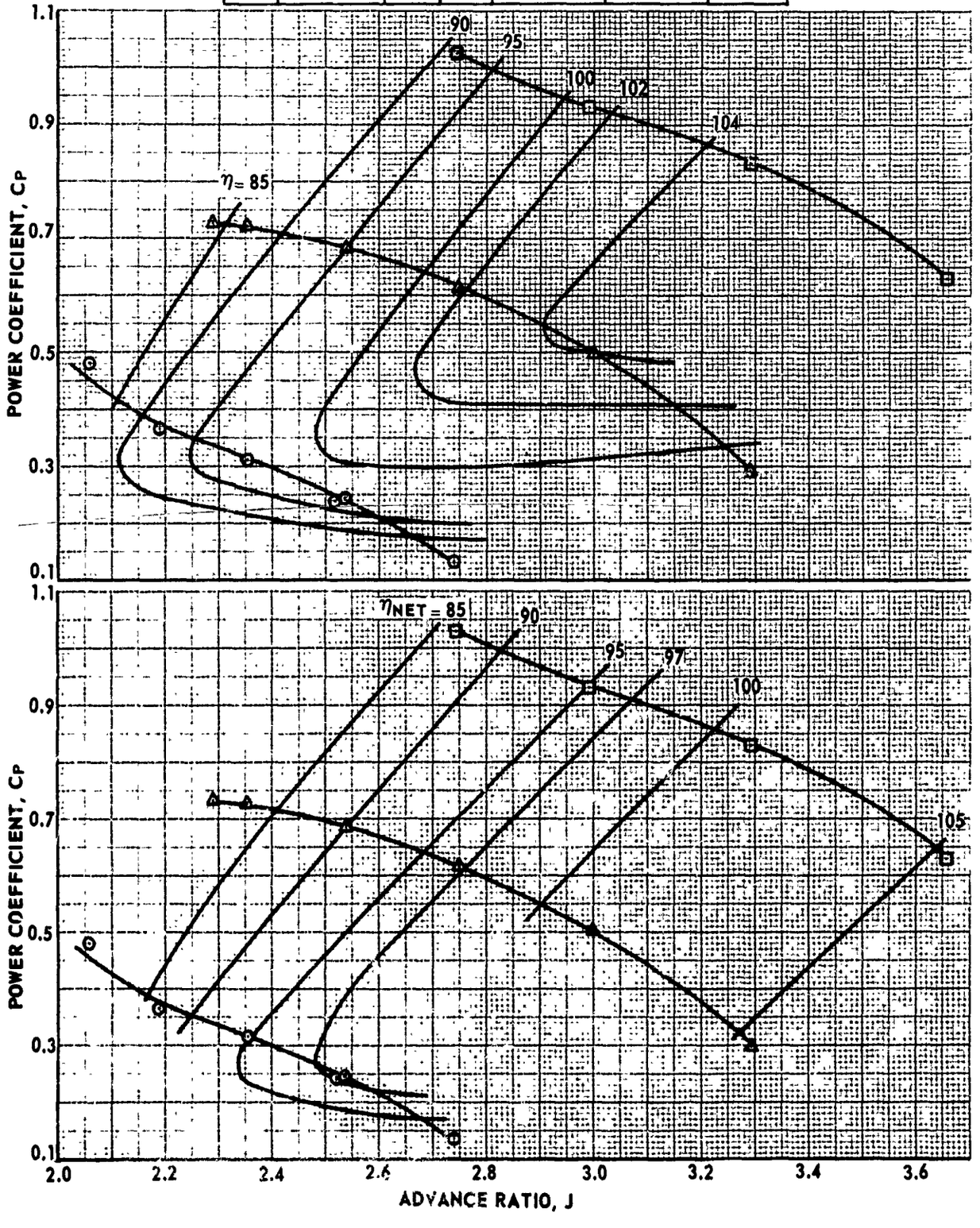
HS VG SHROUDED PROPELLER TEST

FIG. 29

EFFECT OF BLADE ANGLE ON HIGH SPEED SHROUDED PROPELLER PERFORMANCE

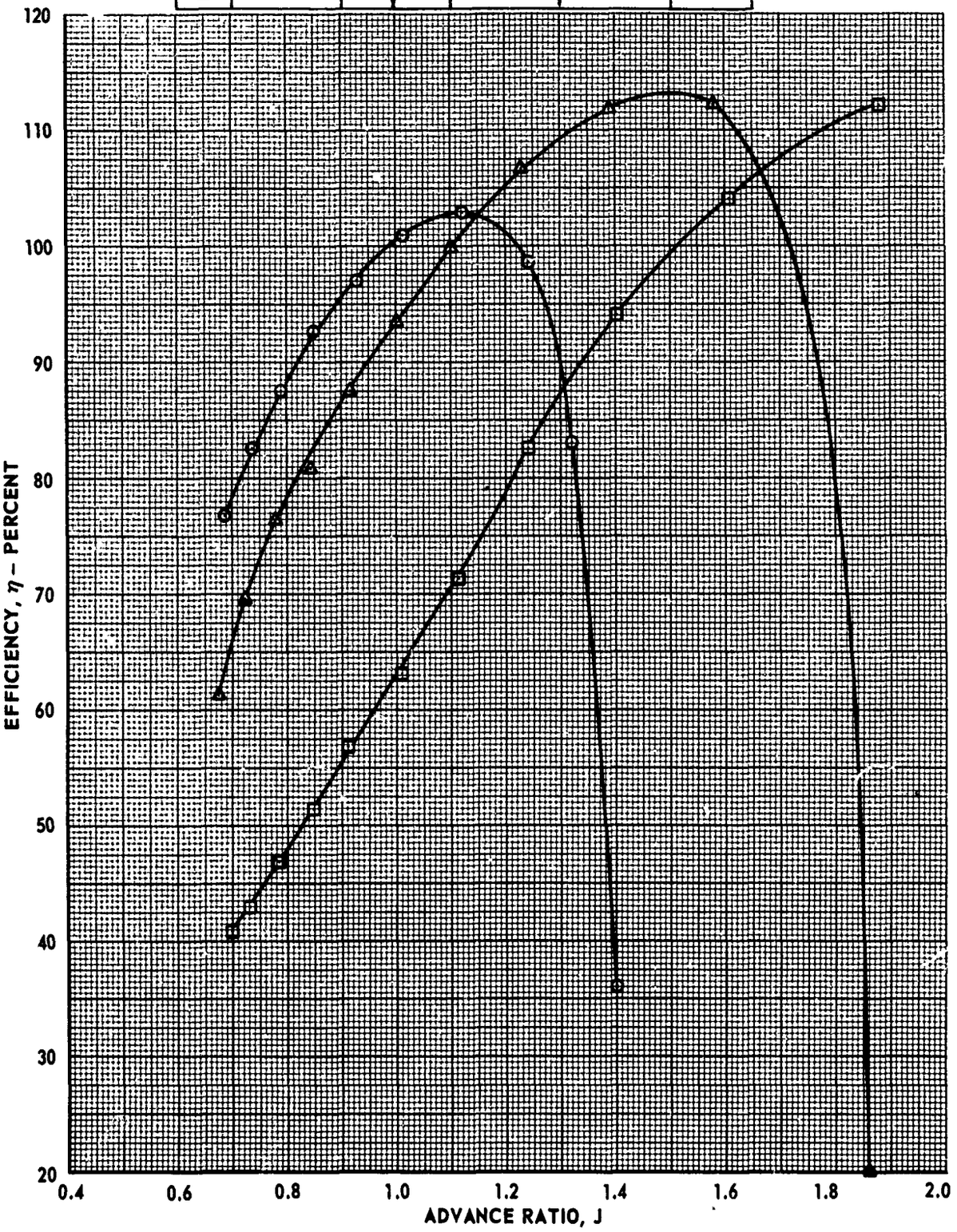
SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	44	0.60	$L_4 C_1 E_7 B_3 P_{NT} T_2 R_1 R_E$	43.0
△	46	↓	↓	49.0
⊡	47	↓	↓	54.0



HS VG SHROUDED PROPELLER TEST

EFFECT OF DIFFUSER E_6 ON HIGH SPEED SHROUDED PROPELLER PERFORMANCE

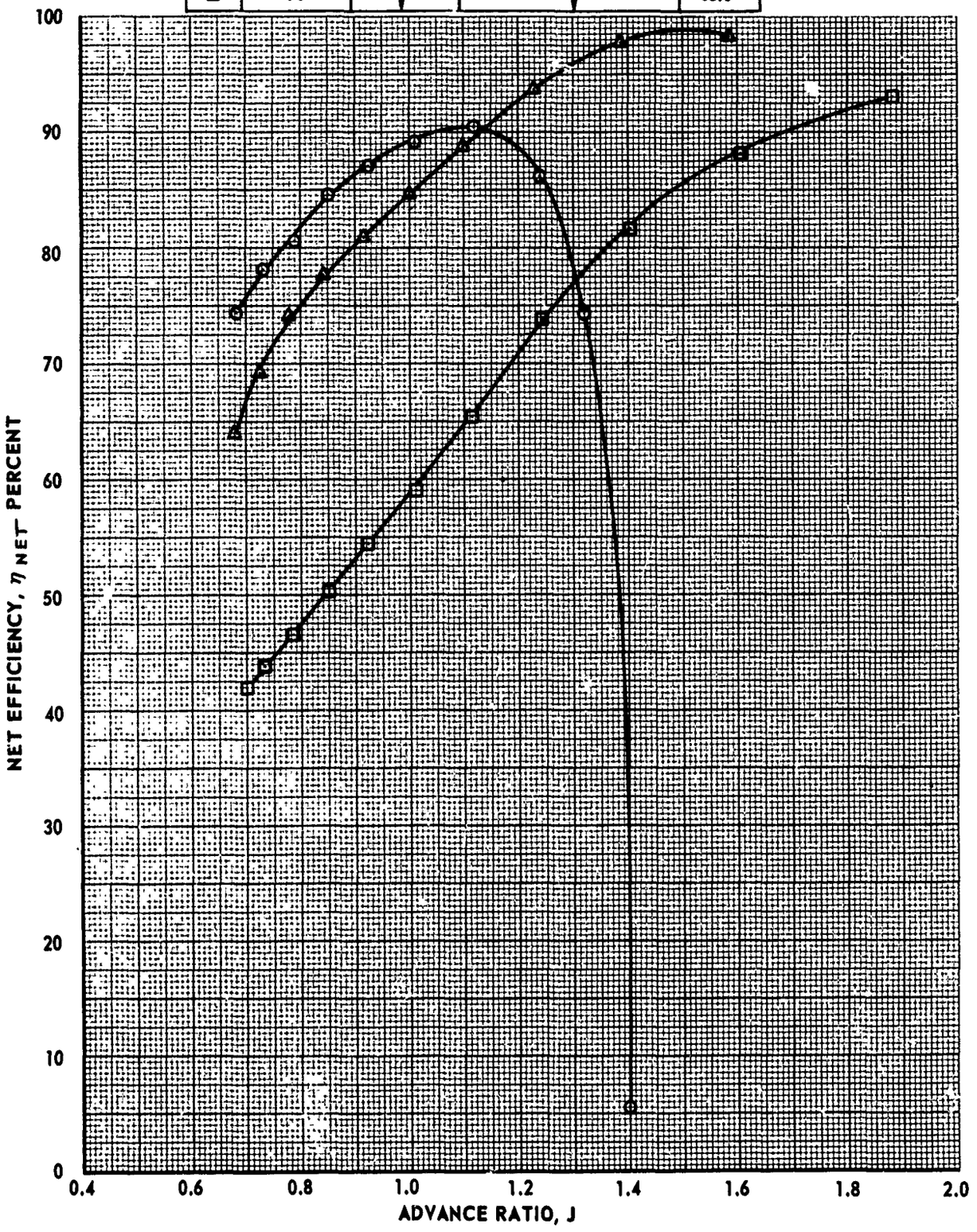
SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	61	0.20	$L_4 C_1 E_6 B_3 P_{NT} T_2 R_1 R_E$	22.0
△	62			28.0
⊡	70			38.0



HS VG SHROUDED PROPELLER TEST

EFFECT OF DIFFUSER E_6 ON HIGH SPEED SHROUDED PROPELLER PERFORMANCE

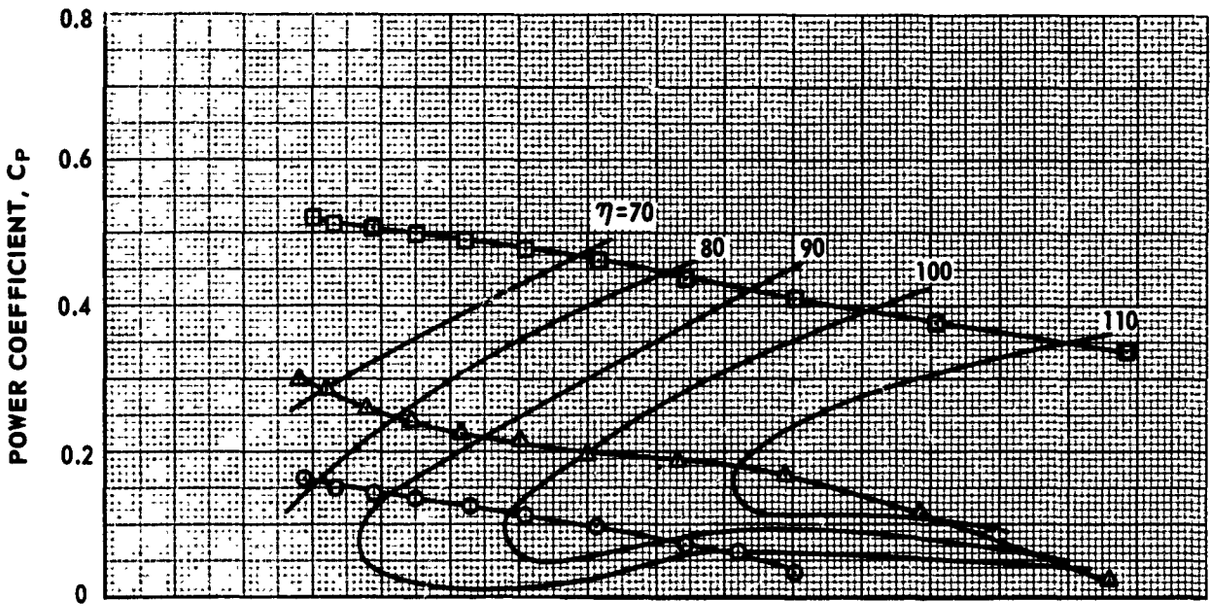
SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	61	0.20	$L_4 C_1 E_6 B_3 P_{NT} T_2 R_1 R_E$	22.0
△	62			28.0
⊡	70			38.0

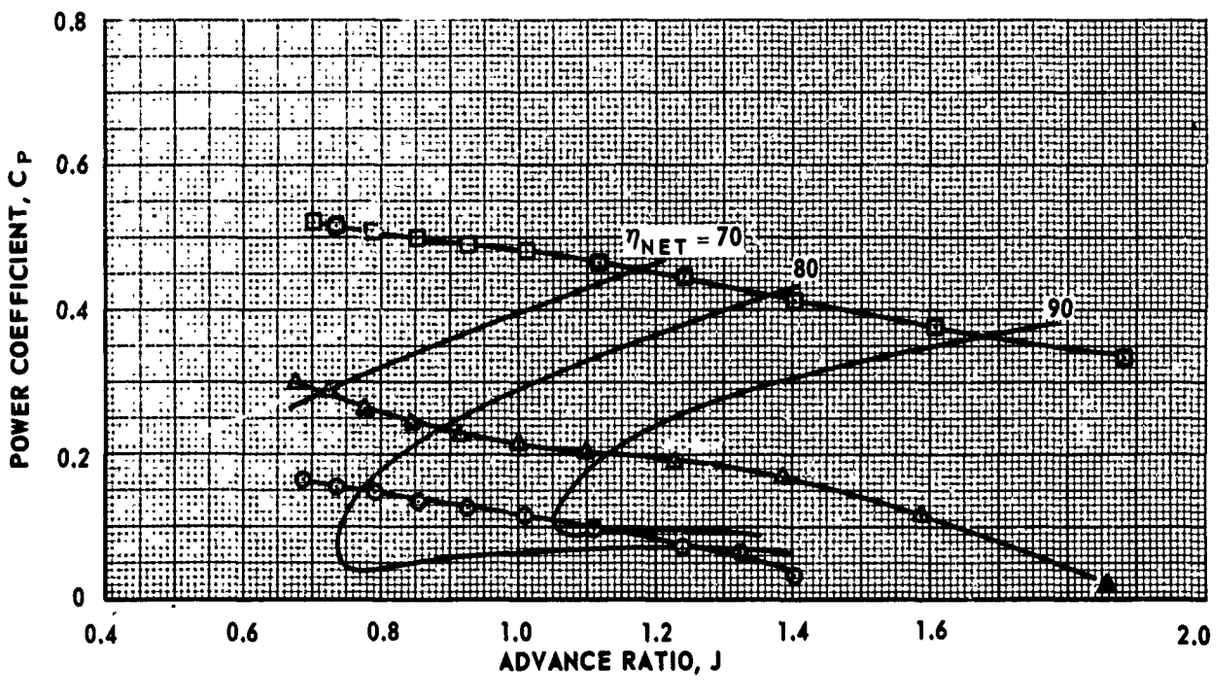


HS VG SHROUDED PROPELLER TEST

EFFECT OF DIFFUSER E_6 ON HIGH SPEED SHROUDED PROPELLER PERFORMANCE

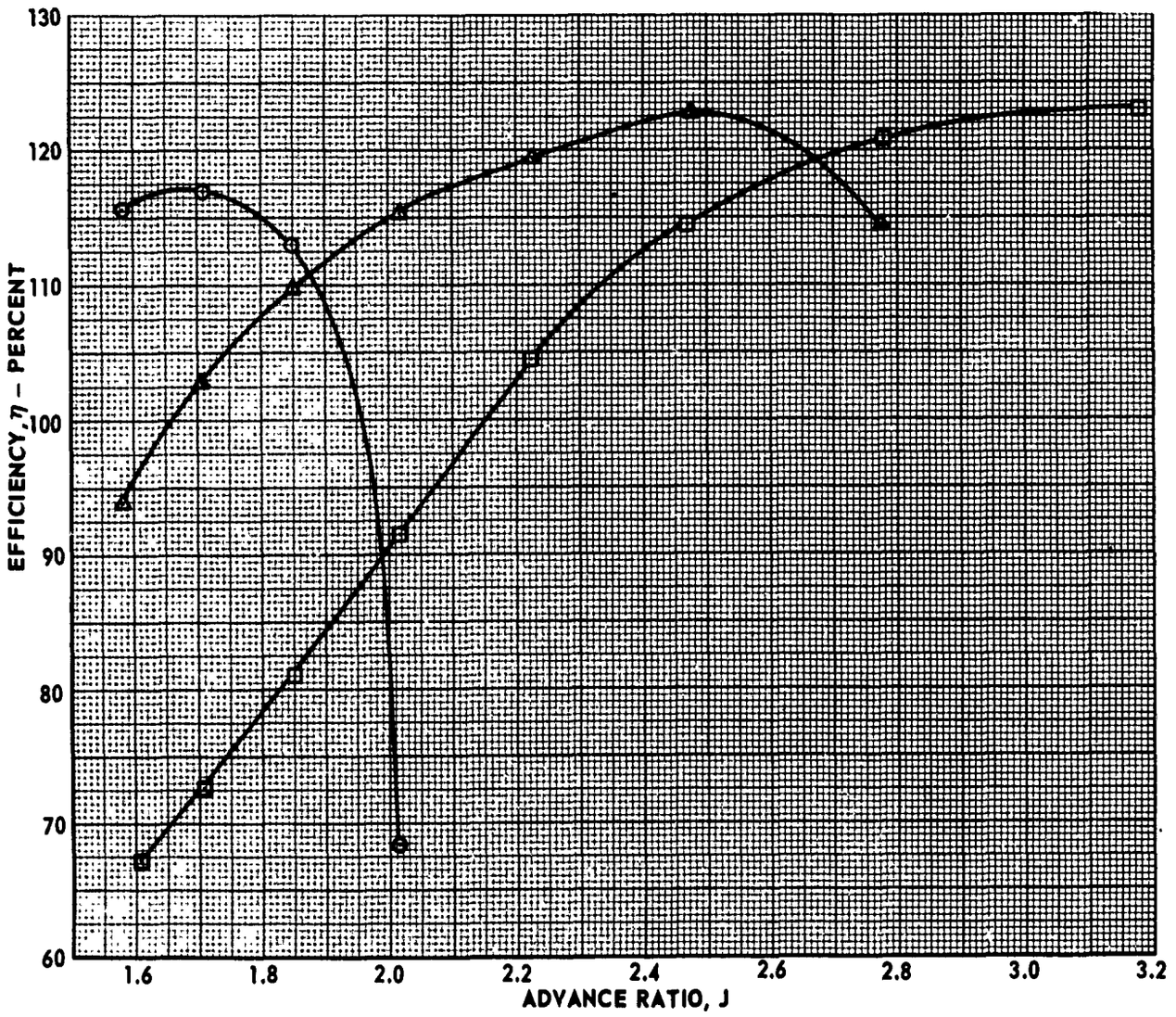
SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	61	0.20	$L_4\ C_1\ E_6\ B_3\ P_{NT}\ T_2\ R_1\ R_E$	22.0
△	62	↓	↓	28.0
⊡	70	↓	↓	38.0





HS VG SHROUDED PROPELLER TEST
EFFECT OF DIFFUSER E_6 ON HIGH SPEED SHROUDED PROPELLER PERFORMANCE

SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	63	0.40	$L_4 C_1 E_6 B_3 P_{NT} T_2 R_1 R_E$	30.0
△	64	↓	↓	41.0
⊡	66	↓	↓	47.0



HS VG SHROUDED PROPELLER TEST

EFFECT OF DIFFUSER E_6 ON HIGH SPEED SHROUDED PROPELLER PERFORMANCE

SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	63	0.40	$L_4 C_1 E_6 B_3 P_{NT} T_2 R_1 R_E$	30.0
△	64			41.0
⊡	66			47.0

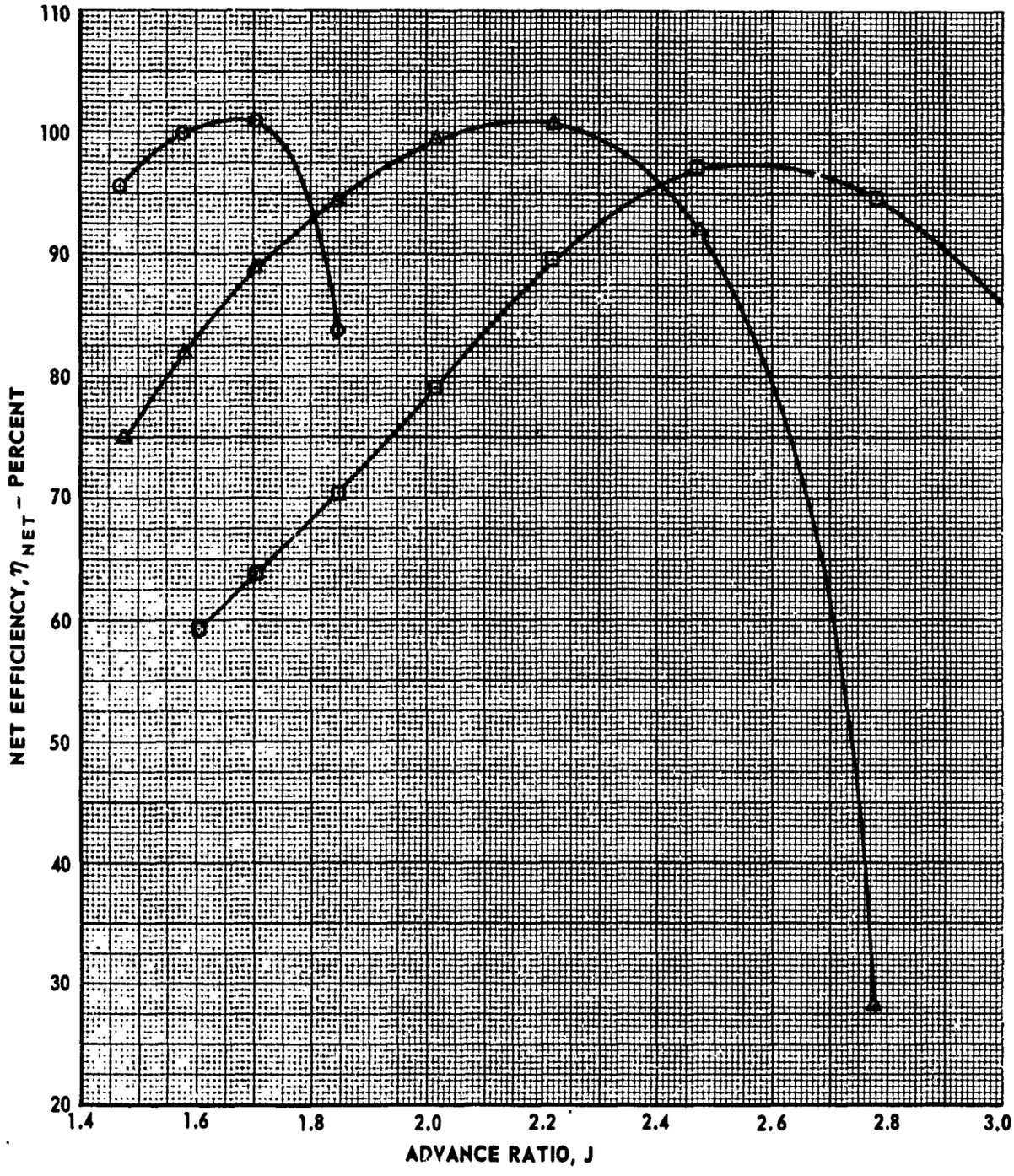
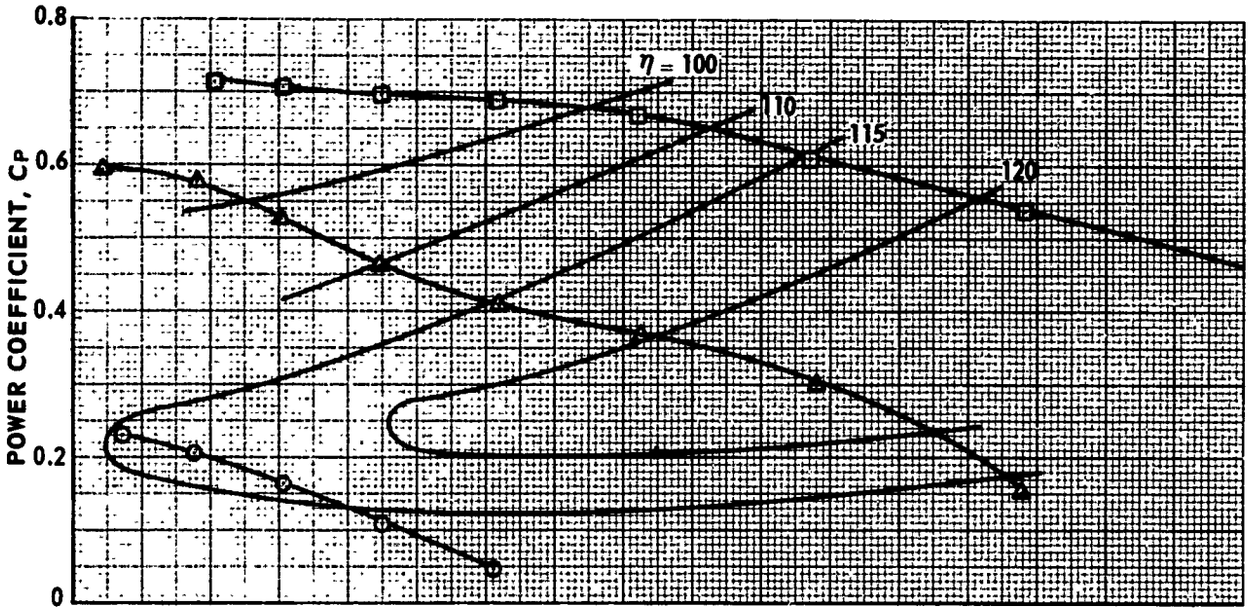


FIG. 35

HS VG SHROUDED PROPELLER TEST

EFFECT OF DIFFUSER E_6 ON HIGH SPEED SHROUDED PROPELLER PERFORMANCE

SYM	RUN NO.	MACH NO.	CONFIGURATION	θ 3/4
⊙	63	0.40	$L_4 C_1 E_6 B_3 P_{NT} T_2 R_1 R_E$	30.0
△	64	↓	↓	41.0
⊡	66	↓	↓	47.0



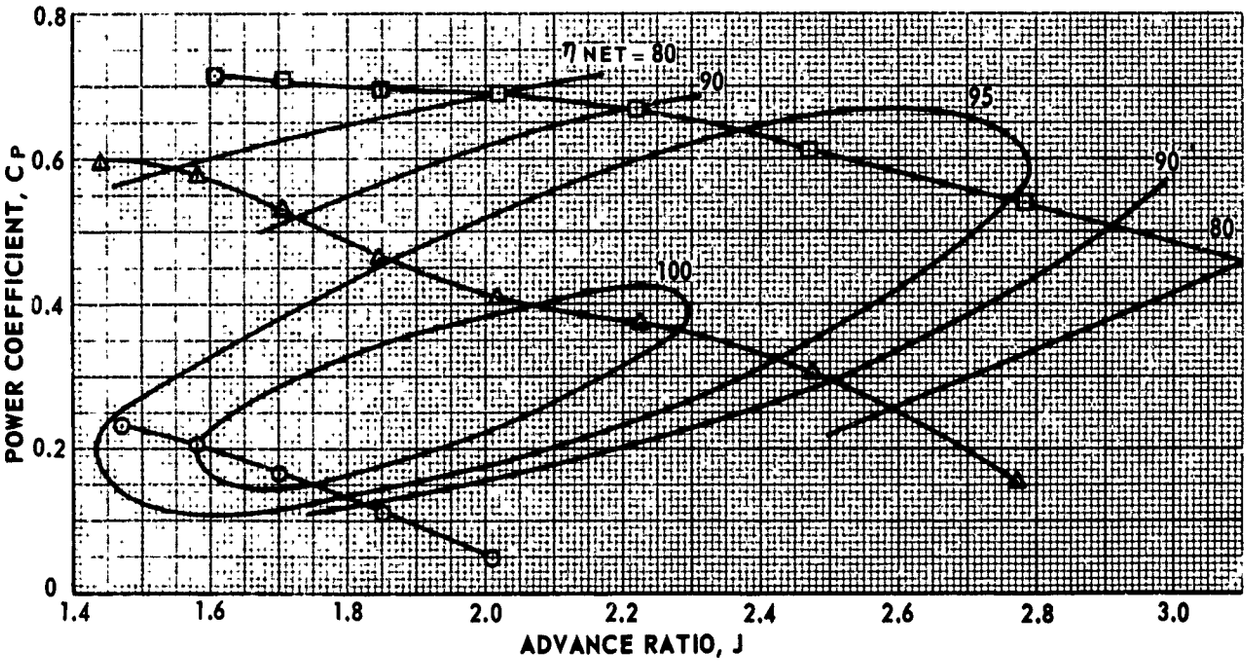


FIG. 36

HS VG SHROUDED PROPELLER TEST

EFFECT OF DIFFUSER E_6 ON HIGH SPEED SHROUDED PROPELLER PERFORMANCE

SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	65	0.60	$L_4 C_1 E_6 B_3 P_{NT} T_2 R_1 R_E$	41.0
△				47.0
⊡	68			52.0
◇	69			38.0

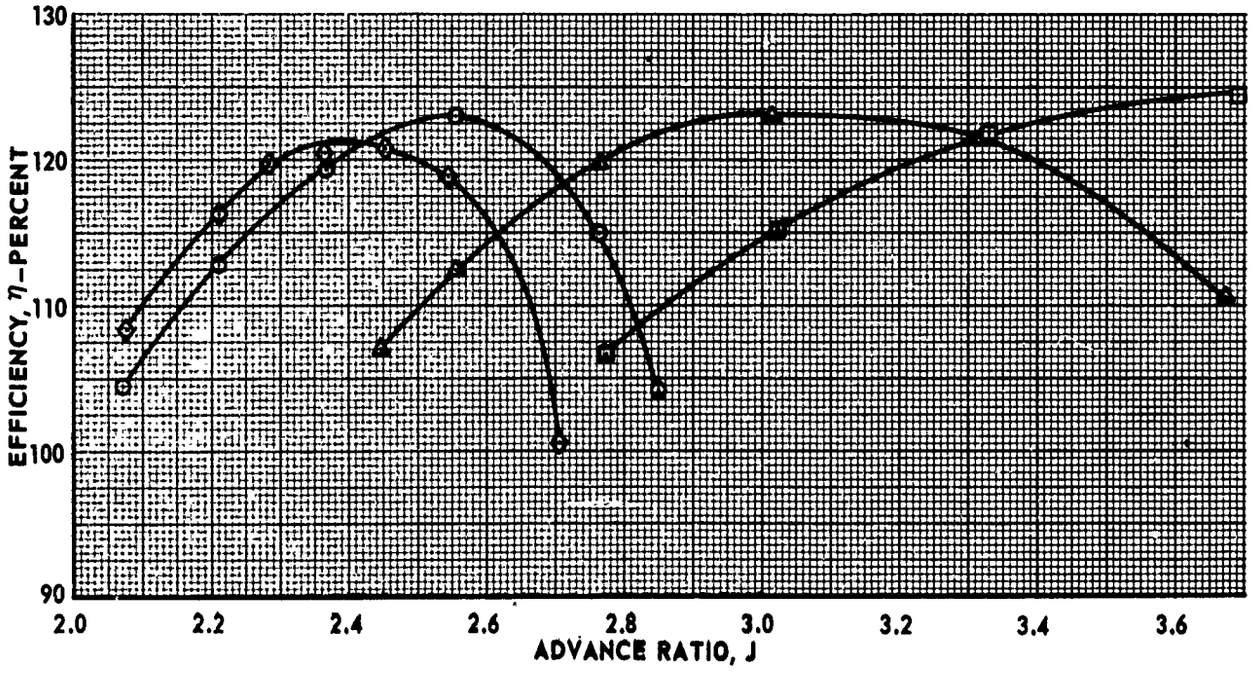
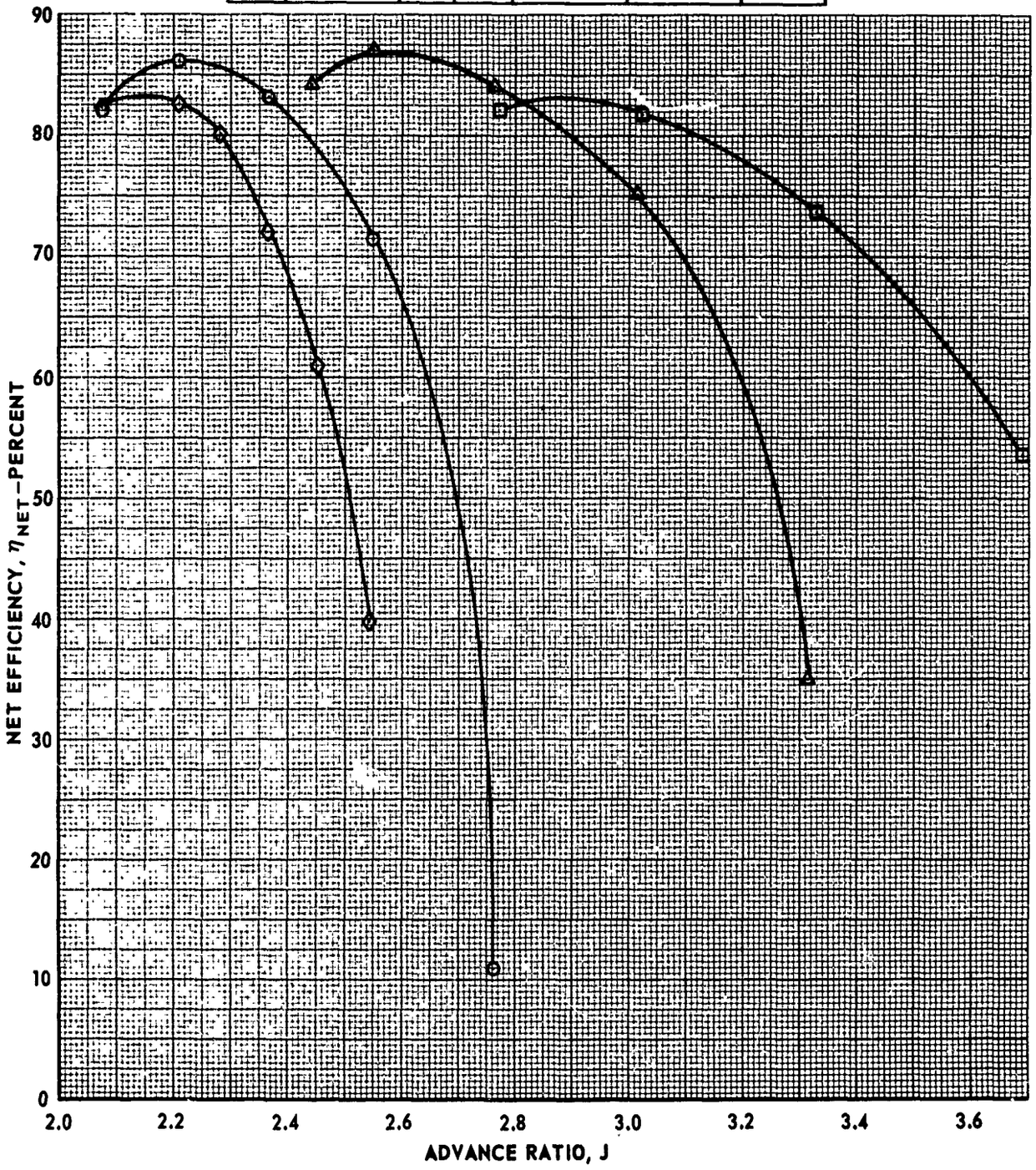


FIG. 37

HS VG SHROUDED PROPELLER TEST

EFFECT OF DIFFUSER E_6 ON HIGH SPEED SHROUDED PROPELLER PERFORMANCE

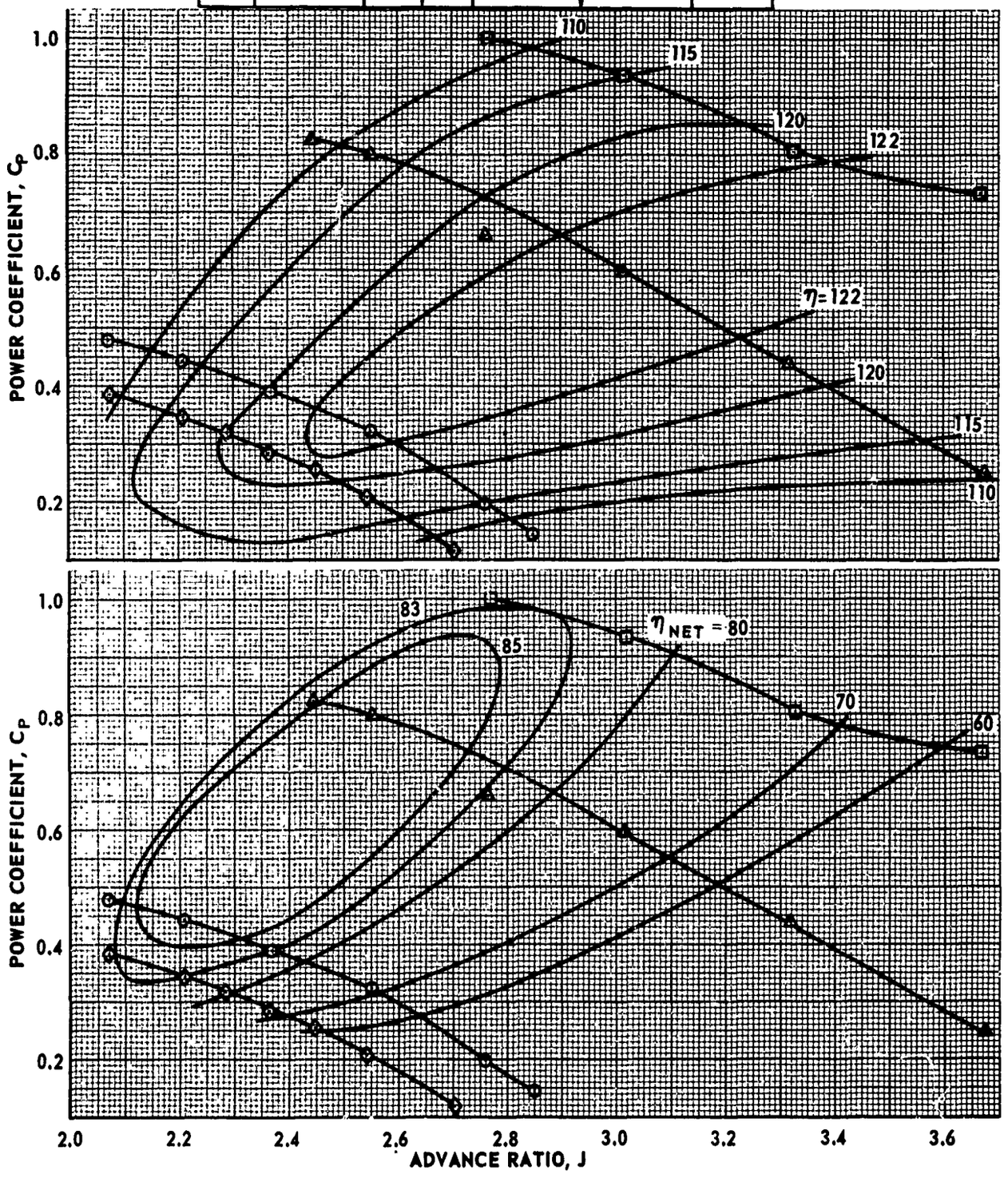
SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	65	0.60	$L_4 C_1 E_6 B_3 P_{NT} T_2 R_1 R_E$	41.0
△	67			47.0
⊡	68			52.0
◇	69			38.0



HS VG SHROUDED PROPELLER TEST

EFFECT OF DIFFUSER E_6 ON HIGH SPEED SHROUDED PROPELLER PERFORMANCE

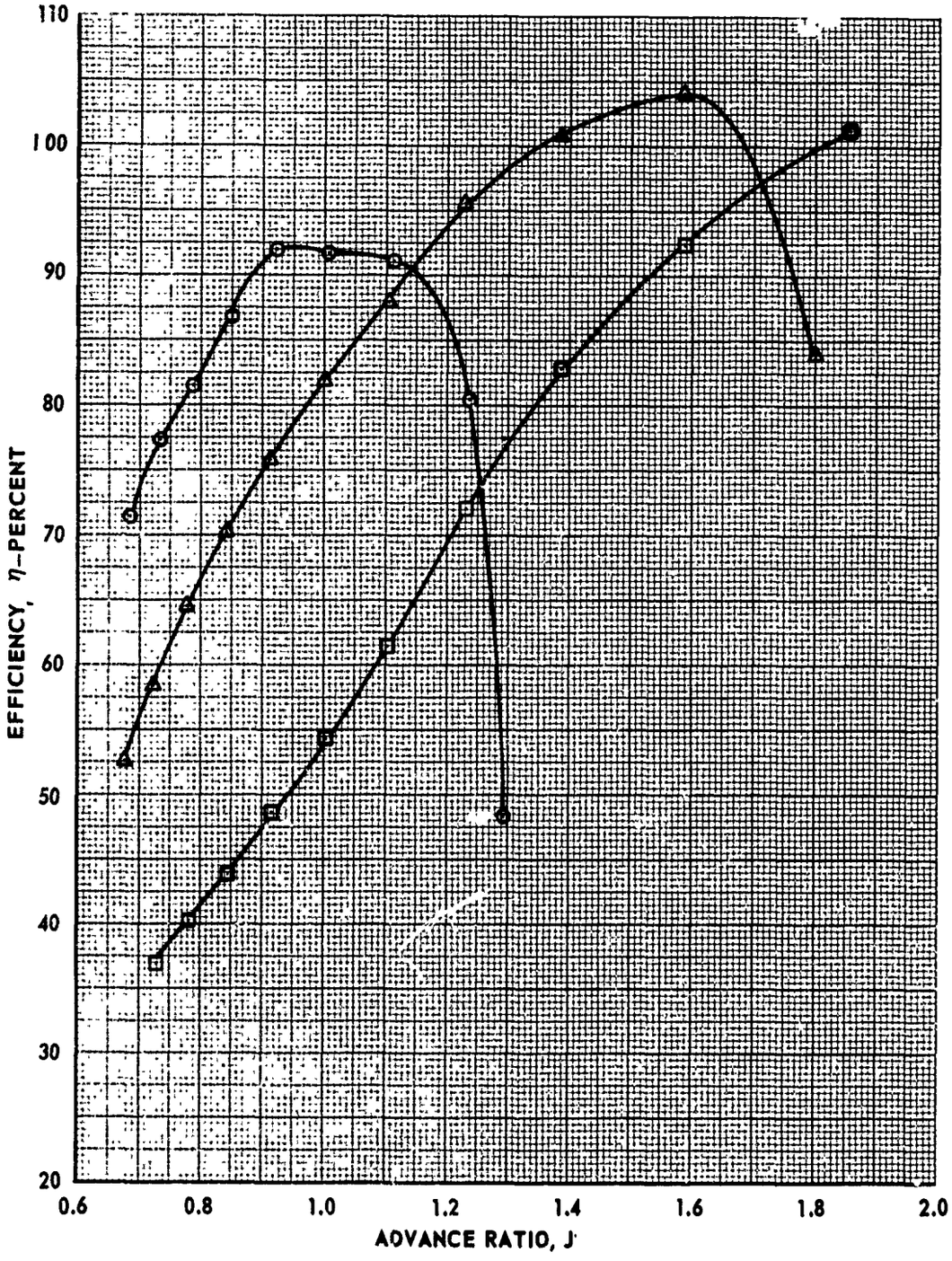
SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	65	0.60	$L_4 C_1 E_6 B_3 P_{NT} T_2 R_1 R_E$	41.0
△	67			47.0
⊡	68			52.0
◇	69			38.0



HS VG SHROUDED PROPELLER TEST

EFFECT OF BLADE GEOMETRY ON HIGH SPEED SHROUDED PROPELLER PERFORMANCE

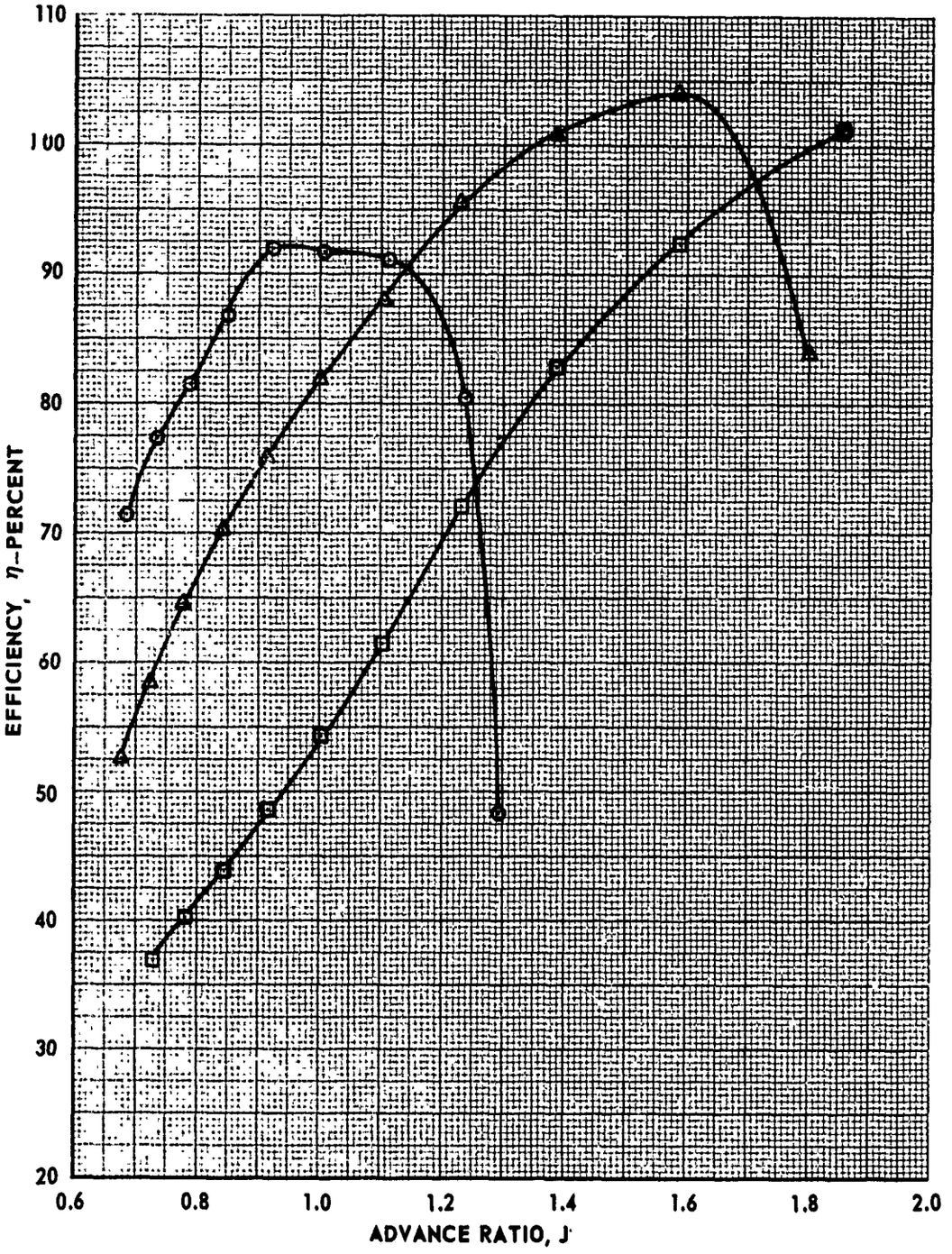
SYM	RUN NO:	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	29	0.20	$L_4 C_1 E_7 B_3 P_{WT} T_1 R_1 R_E$	20.0
△	30			30.0
⊡	33			40.0



HS VG SHROUDED PROPELLER TEST

EFFECT OF BLADE GEOMETRY ON HIGH SPEED SHROUDED PROPELLER PERFORMANCE

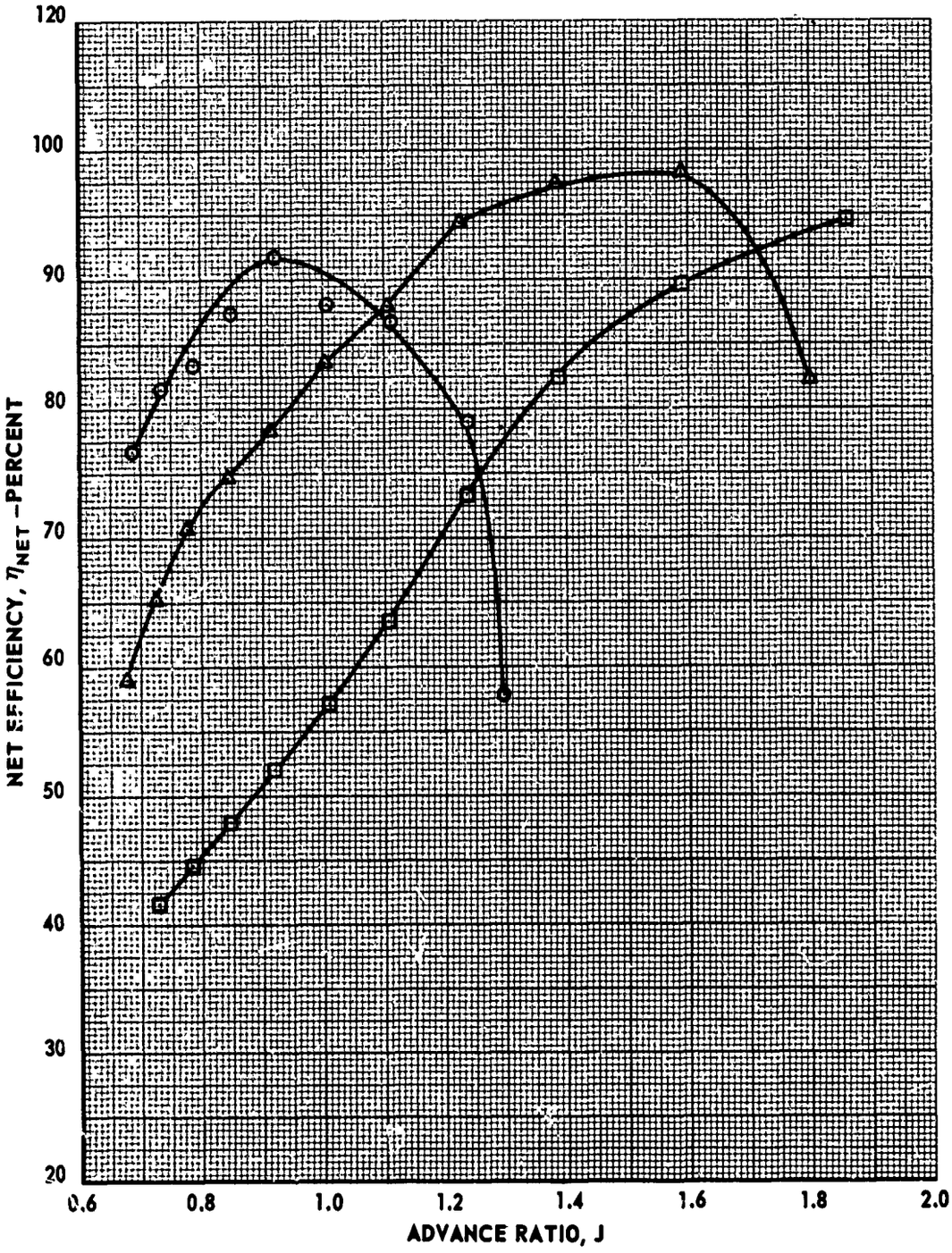
SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	29	0.20	$L_4C_1E_7B_3P_{WT}T_1R_1R_E$	20.0
△	30	↓	↓	30.0
⊡	33	↓	↓	40.0



HS VG SHROUDED PROPELLER TEST

EFFECT OF BLADE GEOMETRY ON HIGH SPEED SHROUDED PROPELLER PERFORMANCE

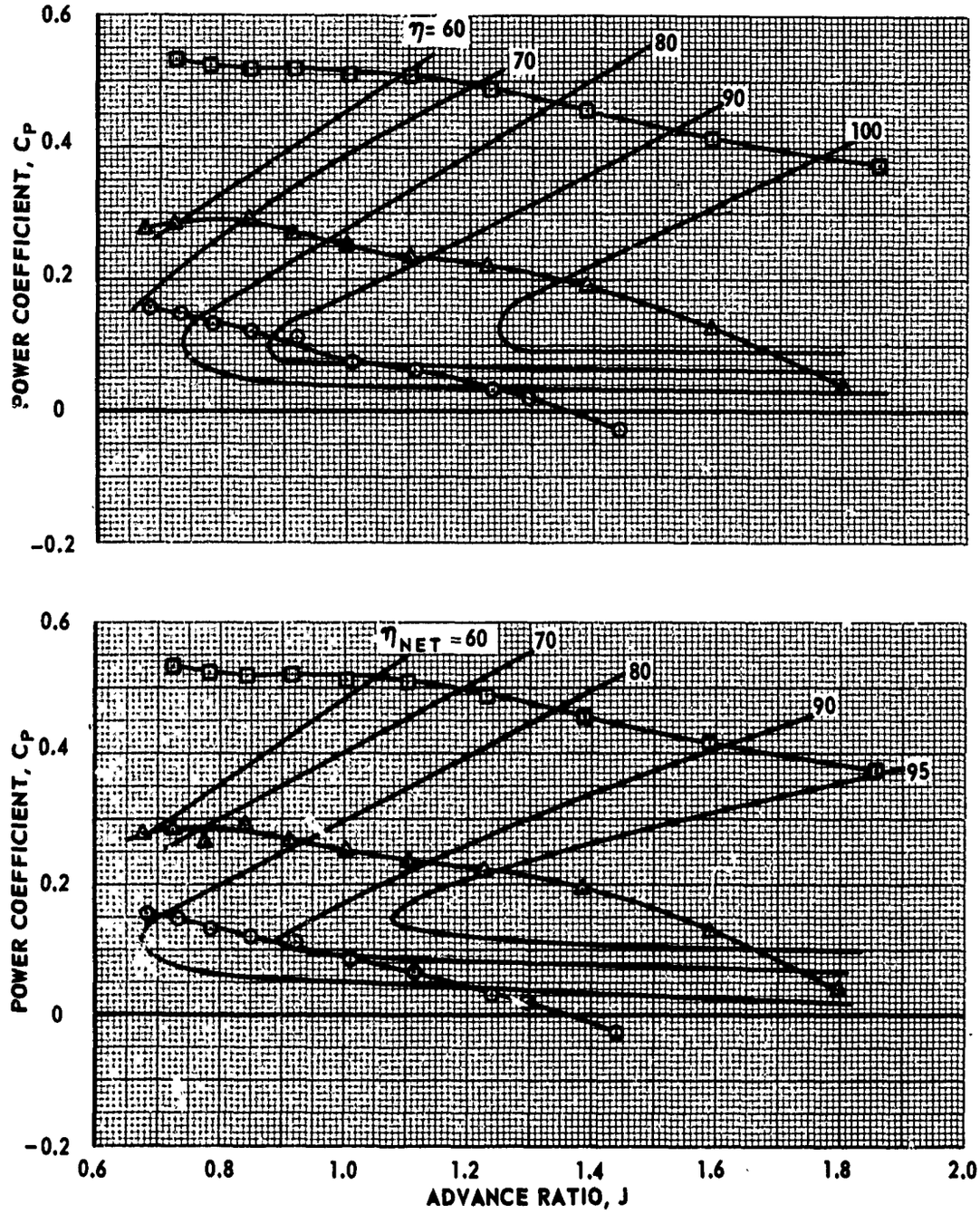
SYM	RUN NO.	MACH NO.	CONFIGURATION	$\beta_{3/4}$
⊙	29	0.20	$L_4C_1E_7B_3P_{WT}T_1R_1R_E$	20.0
△	30			30.0
⊡	33			40.0



HS VG SHROUDED PROPELLER TEST

EFFECT OF BLADE GEOMETRY ON HIGH SPEED SHROUDED PROPELLER PERFORMANCE

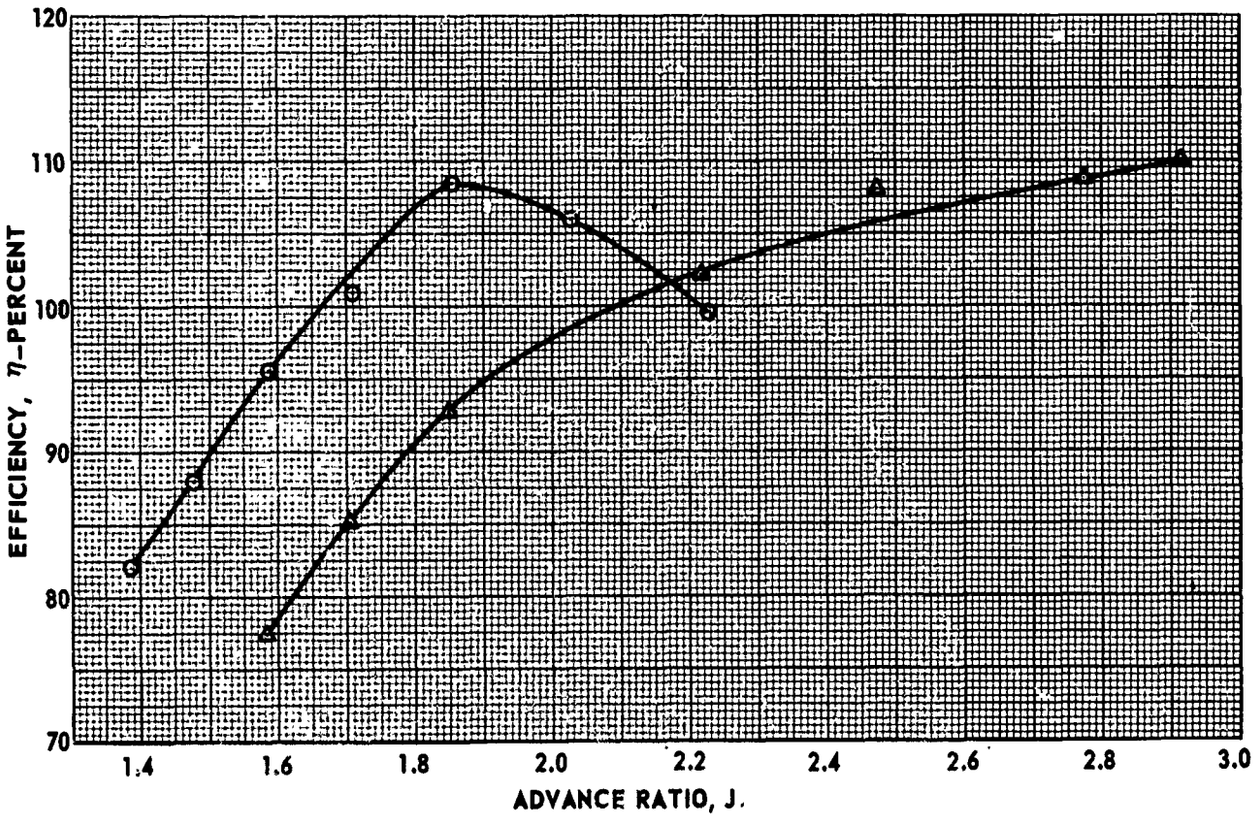
SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	29	0.20	$L_4C_1E_7B_3P_{WT}T_1R_1R_E$	20.0
△	30	↓	↓	30.0
⊡	33	↓	↓	40.0



HS VG SHROUDED PROPELLER TEST

EFFECT OF BLADE GEOMETRY ON HIGH SPEED SHROUDED PROPELLER PERFORMANCE

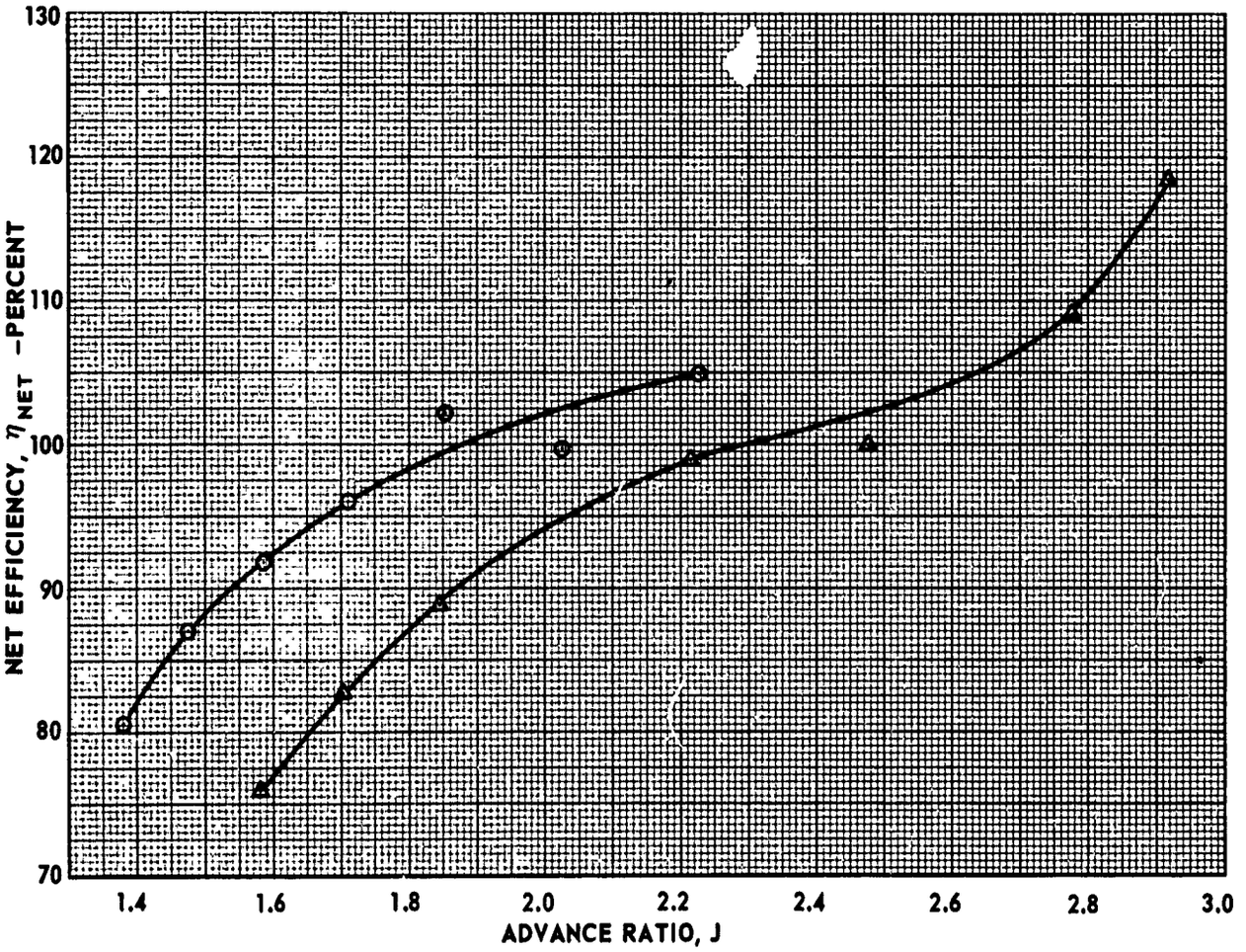
SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	32	0.40	$L_4 C_1 E_7 B_3 P_{WT} T_1 R_1 R_E$	36.0
△	34	↓	↓	43.0



HS VG SHROUDED PROPELLER TEST

EFFECT OF BLADE GEOMETRY ON HIGH SPEED SHROUDED PROPELLER PERFORMANCE

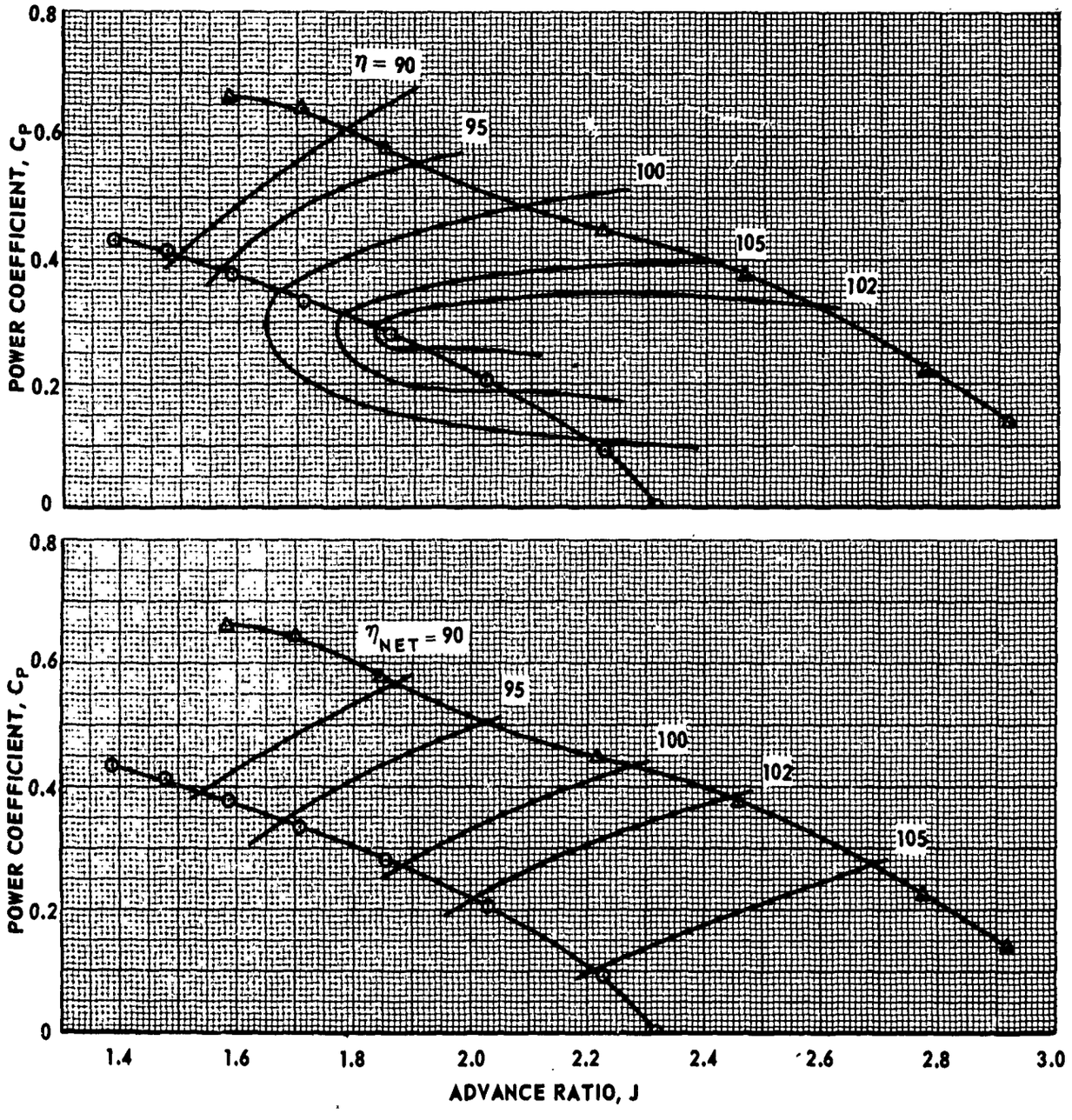
SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	32	0.40	$L_4 C_1 E_7 B_3 P_{WT} T_1 R_1 R_E$	36.0
△	34	↓	↓	43.0



HS VG SHROUDED PROPELLER TEST

EFFECT OF BLADE GEOMETRY ON HIGH SPEED SHROUDED PROPELLER PERFORMANCE

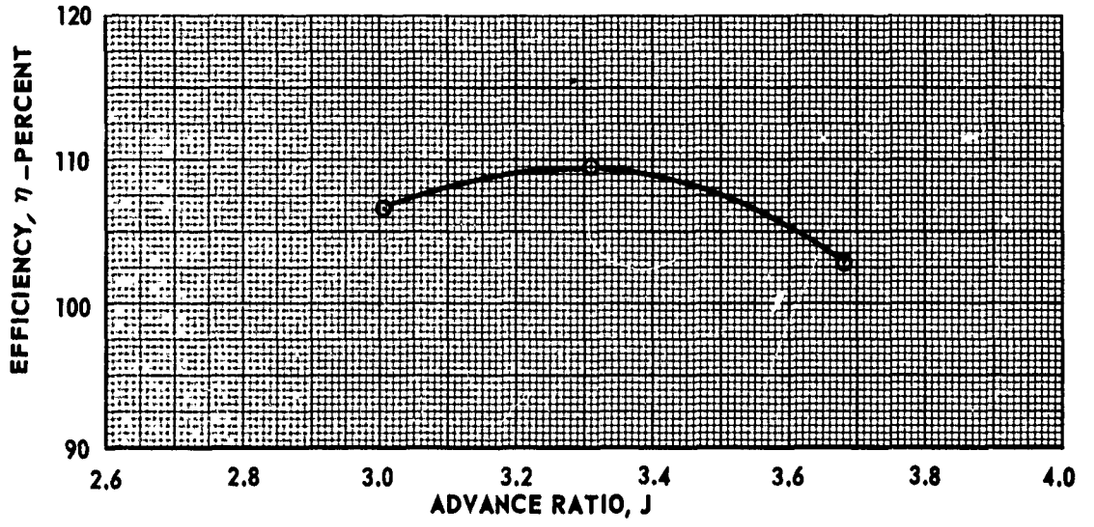
SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	32	0.40	$L_4C_1E_7B_3P_{WT}T_1R_1R_E$	36.0
△	34	↓	↓	43.0



HS VG SHROUDED PROPELLER TEST

EFFECT OF BLADE GEOMETRY ON HIGH SPEED SHROUDED PROPELLER PERFORMANCE

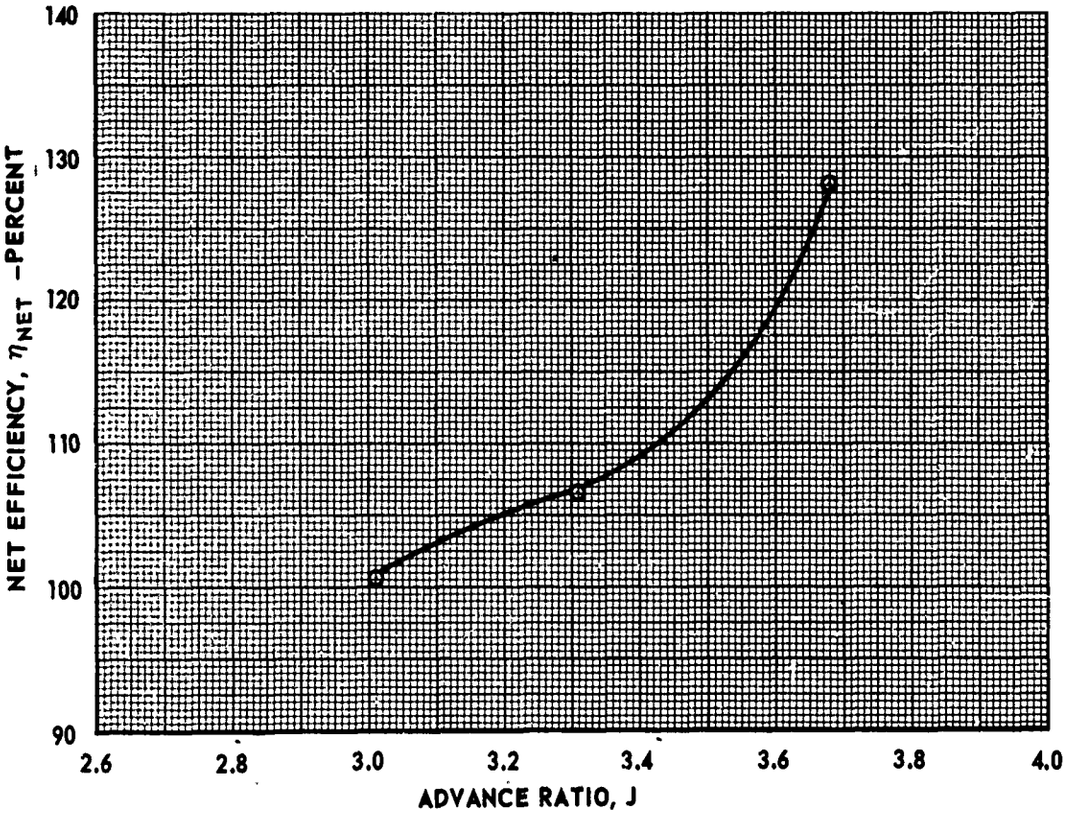
SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	37	0.60	$L_4 C_1 E_7 B_3 P_{WT} T_1 R_1 R_E$	50.0



HS VG SHROUDED PROPELLER TEST

EFFECT OF BLADE GEOMETRY ON HIGH SPEED SHROUDED PROPELLER PERFORMANCE

SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	37	0.60	$L_4C_1E_7B_3P_{WT}T_1R_1R_E$	50.0 ·



HS VG SHROUDED PROPELLER TEST

EFFECT OF BLADE GEOMETRY ON HIGH SPEED SHROUDED PROPELLER PERFORMANCE

SYM	RUN NO.	MACH NO.	CONFIGURATION	$\theta_{3/4}$
⊙	37	0.60	$L_4C_1E_7B_3P_{WT}T_1R_1R_E$	50.0

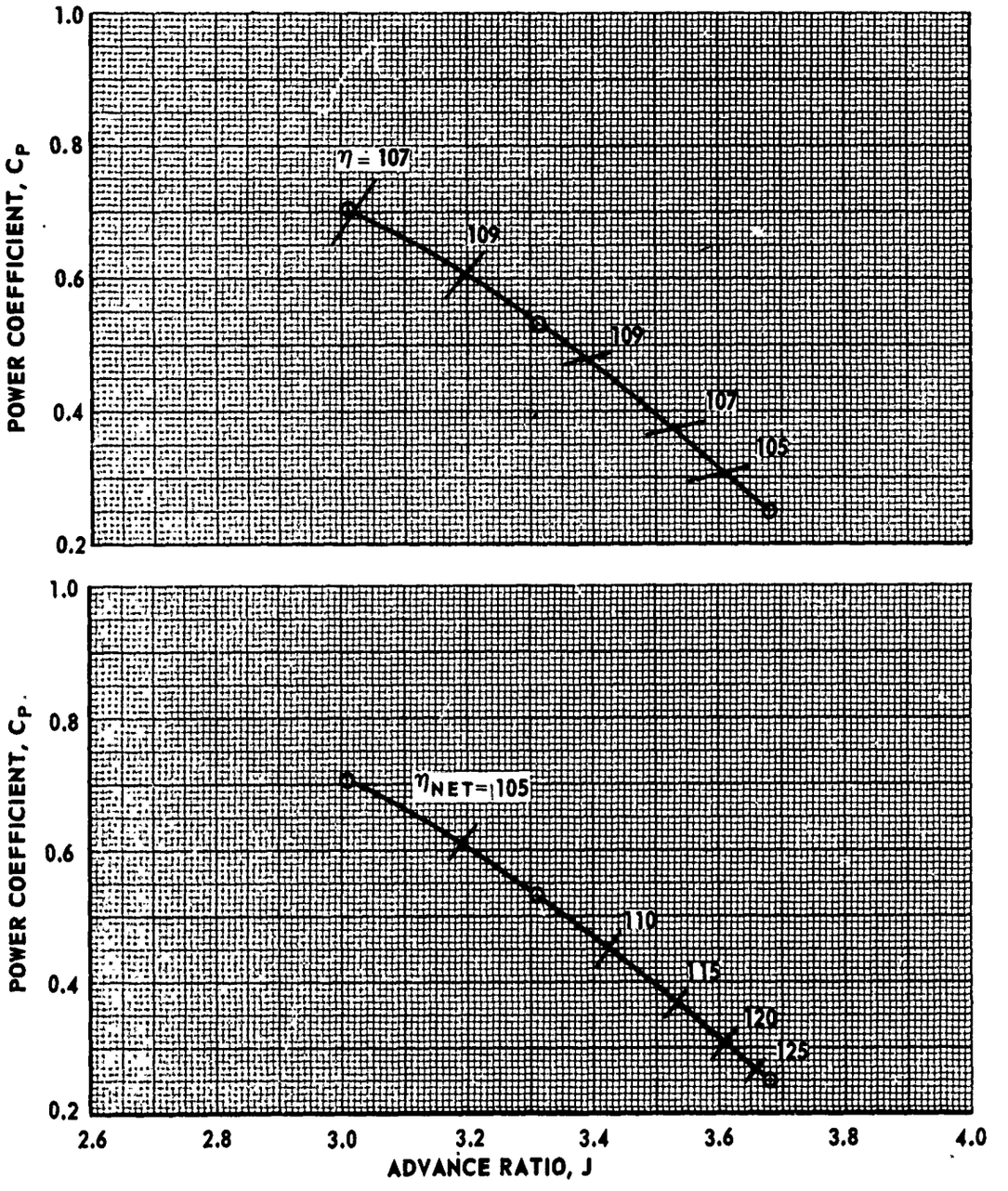


TABLE I

HS VG SHROUDED PROPELLER TEST

Test Schedule

I. Performance Data (Table III)

Configuration	Run Number	Mach Number Range	Figure Number
$L_5C_1E_8B_3P_{WT}T_1R_1R_E$	4-14, 21	0.02, 0.05, 0.10, 0.20	9, 10, 15-20
L_4 E_7 ↓ ↓	29-37	0.2, 0.4, 0.6	11, 12, 39-47
↓ ↓ $P_{NT}T_2$	39-48	0.2, 0.4, 0.6	13, 14, 21-29
↓ ↓ E_6 ↓ ↓ ↓ ↓	60-71	0.2, 0.4, 0.6	13, 14, 30-38

II. Pressure Data (Tables VI and VII)

Configuration	Run Number	Mach Number Range	Tabulations Presented	
			Trav. Probe Table VI	*Pressure Table VII
$L_5C_1E_8B_3P_{WT}T_1R_1R_ET_P$	22-24	0.02, 0.05, 0.10	X	X
L_4 E_7 $P_{NT}T_2$ ↓ ↓ ↓	54-59	0.2, 0.4, 0.6	↓	↓
↓ ↓ E_6 ↓ ↓ ↓ ↓ ↓	77-80	0.2, 0.4, 0.6	↓	↓

* Surface pressures, inlet rake, exit rake at one radial station and three propeller rotational speeds, excepting Run 56 where two rotational speeds are included.

TABLE II

HS VG SHROUDED PROPELLER TEST

Wind Tunnel Run Log

Run	Configuration	$\theta_{3/4}$	Test Conditions		Test Objective	Remarks
			Mach No.	RPM		
1	PTR + $R_{G_1} R_{G_5}$	-	Varied	-	Calib.	
2	$L_5 C_1 E_8 B_4 R_1 R_E$	-	Varied	-	Calib.	
3	$L_5 C_1 E_8 B_3 P_{WT} T_1 R_1 R_E$	10	0	Varied	Static bal.	
4	↓	22	.02	↓	Performance	
5	↓	↓	.05	↓	↓	
6	↓	↓	.10	↓	↓	
7	↓	29	.02	↓	↓	
8	↓	↓	.05	↓	↓	
9	↓	↓	.10	↓	↓	
10	↓	36	.02	↓	↓	Aborted: incorrect M
11	↓	↓	.10	↓	↓	
12	↓	↓	.05	↓	↓	
13	↓	↓	.02	↓	↓	
14	↓	↓	.20	↓	↓	
15	A_D	↓	.10	↓	A-frame T&I's	
16	↓	↓	.02	↓	↓	

TABLE II
(Contd.)

Run	Configuration	θ 3/4	Test Conditions		Test Objective	Remarks
			Mach No.	RPM		
17	$L_5C_1E_8B_3P_{WT}T_1R_1A_D$	22	.02	Varied	A-frame T&I's	
18	↓	↓	.05	↓	↓	
19	↓	29	↓	↓	↓	
20	↓	↓	.10	↓	↓	
21	R_E	↓	.05	↓	Performance	Repeat of Run 8
22	T_P	↓	.02	7000	Pressure	Addl. pts. at 7500 & 6500 rpm
23	↓	↓	.05	↓	↓	↓
24	↓	↓	.10	↓	↓	↓
25	Clear Test Section	-	Varied	-	Calib.	
26	PTR + $R_{G_1}R_{G_5}$	↓	↓	↓	↓	
27	$L_4C_1E_7B_4$ R_1R_E	↓	↓	↓	↓	
28	$B_3P_{WT}T_1$	10	0	Varied	Static balance	
29	↓	20	.20	↓	Performance	
30	↓	30	↓	↓	↓	
31	↓	↓	.40	↓	↓	Aborted: neg. C_T
32	↓	36	↓	↓	↓	

TABLE II
(Contd.)

Run	Configuration	$\theta_{3/4}$	Test Conditions		Test Objective	Remarks
			Mach No.	RPM		
33	$L_4C_1E_7B_3P_{WT}T_1R_1R_E$	40	.20	Varied	Performance	
34		43	.40			
35		50				
36						Repeat of Run 35
37			.60			Aborted: blade damage
38	$P_{NT}T_2$	10	0		Static balance	
39		22	.20		Performance	
40		30				
41		32	.40			
42		40	.20			
43		43	.40			
44			.60			
45		49	.40			
46			.60			
47		54	.60			
48		30	.20			Repeat of Run 40
49	A_D				A-frame T&I's	

TABLE II
(Contd.)

Run	Configuration	$\theta_{3/4}$	Test Conditions		Test Objective	Remarks
			Mach No.	RPM		
50	$L_4C_1E_7B_3P_{NT}T_2R_1$ A_D	49	.60	Varied	A-frame T&I's	
51	↓	↓	.40	↓	↓	
52	↓	43	.60	↓	↓	
53	↓	↓	.40	↓	↓	
54	R_ET_P	↓	.40	7000	Pressure	Addtl. data at 4300 & 5500 rpm
55	↓	↓	↓	↓	↓	Addtl. data at 4300 & 5500 rpm
56	↓	↓	.60	↓	↓	Addtl. data at 6300 rpm
57	↓	32	.40	↓	↓	Addtl. data at 6000 & 8000 rpm
58	↓	30	.20	↓	↓	Addtl. data at 6000 & 8000 rpm
59	↓	↓	↓	↓	↓	Repeat of Run 58. Addtl. data at 6000 & 8000 rpm
60	E_6	22	↓	Varied	Perfo. nance	Aborted: LGP-30 ir erative
61	↓	↓	↓	↓	↓	

TABLE II
(Contd.)

Run	Configuration	$\theta_{3/4}$	Test Conditions		Test Objective	Remarks
			Mach No.	RPM		
62	$L_4C_1E_6B_3P_{NT}T_2R_1R_E$	28	.20	Varied	Performance	
63	↓	30	.40	↓	↓	
64	↓	41	↓	↓	↓	
65	↓	↓	.60	↓	↓	
66	↓	47	.40	↓	↓	
67	↓	↓	.60	↓	↓	
68	↓	52	↓	↓	↓	
69	↓	38	↓	↓	↓	
70	↓	↓	.20	↓	↓	
71	↓	28	↓	↓	↓	Repeat of Run 62
72	↓ A_D	28	↓	↓	A-frame T&I's	
73	↓	41	.40	↓	↓	
74	↓	↓	.60	↓	↓	
75	↓	47	.40	↓	↓	Power limit @6950 rpm
76	↓	↓	.60	↓	↓	Power limit @6800 rpm
77	↓ R_ET_P	28	.20	6500	Pressure	Addtl. data @5500 & 7500 rpm

TABLE II
(Contd.)

Run	Configuration	$\theta_{3/4}$	Test Conditions		Test Objective	Remarks
			Mach No.	RPM		
78	$L_4C_1E_6B_3P_{NT}T_2R_1R_ET_P$	30	.40	6500	Pressure	Aborted: excessive press. on shroud LE
79	↓	↓	↓	↓	↓	Addtl. data @ 5500 & 7500 rpm
80	↓	41	.60	↓	↓	↓
81	B_4	-	Varied	-	Shroud forces & pressure	
82	↓	↓	↓	↓	PTR buoyancy	
83	PTR + $R_{E_5}R_1R_ET_P$	↓	.20	↓	↓	
84	↓	↓	.10	↓	↓	
85	↓	↓	.30, .50	↓	↓	
86	↓	↓	.40	↓	↓	
87	↓	↓	.60	↓	↓	
88	B_3P_{NT}	43	.40	Varied	↓	
89	T_{P4}	-	Varied	-	Calib.	$\theta = -1^{\circ}30'$ d = 32.44"
90	↓	↓	↓	↓	↓	$\theta = -12^{\circ}50'$ d = 30.86"

TABLE II
(Contd.)

Run	Configuration	θ 3/4	Test Conditions		Test Objective	Remarks
			Mach No.	RPM		
91	T_{P4}	-	Varied	-	Calib.	$\theta = 23^{\circ}22'$ d = 29.74"
92	↓	↓	↓	↓	↓	$\theta = -44^{\circ}12'$ d = 27.83"
93	↓	↓	↓	↓	↓	$\theta = 32^{\circ}40'$ d = 28.83"

TABLE III

HS VG SHROUDED PROPELLER TEST

PERFORMANCE DATA

RUN 4 M = 0.02 THETA 3/4 = 22.00 DEG CONF L5 C1 E8 B3 PWT T1 R1 RE

PT	J	V0 VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	.1784	22.57	.190	.1424	.1335	6.892	.1257
		392.04	.358	.2682			
3	.1523	22.57	.163	.1421	.1326	10.864	.1371
		457.36	.320	.2792			
4	.1522	22.57	.155	.1429	.1403	11.496	.1444
		457.36	.311	.2873			
5	.1327	22.57	.143	.1426	.1324	16.167	.1578
		522.42	.301	.3004			
6	.1175	22.57	.127	.1422	.1315	22.890	.1597
		587.87	.269	.3020			
7	.1053	22.57	.113	.1424	.1319	31.447	.1690
		652.92	.248	.3114			
8	.0952	22.57	.102	.1427	.1323	42.160	.1721
		719.16	.226	.3148			
9	.0869	22.57	.092	.1436	.1344	55.470	.1846
		783.95	.212	.3282			
10	.0799	22.57	.084	.1442	.1358	71.175	.1871
		849.01	.195	.3313			
11	.0748	22.57	.078	.1447	.1377	90.135	.1926
		914.33	.183	.3373			
12	.0698	22.57	.071	.1464	.1423	114.579	.2029
		979.65	.171	.3493			
13	.0654	22.57	.065	.1452	.1451	141.916	.2002
		1045.23	.155	.3454			

TABLE III

HS VG SHROUDED PROPELLER TEST

PERFORMANCE DATA

RUN 5 M = 0.05 THETA 3/4 = 22.00 DEG CONF L5 C1 E8 B3 PWT T1 R1 RE

PT	J	V0 VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	.4528	56.41	.427	.1163	.1232	6.351	.0402
		392.04	.575	.1565			
3	.3876	56.41	.380	.1257	.1280	10.460	.0624
		457.10	.569	.1880			
4	.3385	56.41	.340	.1294	.1287	15.715	.0763
		522.55	.541	.2058			
5	.3004	56.41	.309	.1324	.1285	22.330	.0887
		587.73	.516	.2211			
6	.2698	56.41	.277	.1344	.1305	31.128	.1005
		653.18	.485	.2349			
7	.2449	56.41	.253	.1360	.1314	41.697	.1106
		718.37	.459	.2467			
8	.2241	56.41	.231	.1376	.1331	54.834	.1203
		783.82	.434	.2580			
9	.2064	6.41	.213	.1391	.1348	70.642	.1297
		849.27	.411	.2688			
10	.1913	56.41	.196	.1403	.1369	89.629	.1381
		914.59	.389	.2784			
11	.1781	56.41	.180	.1421	.1401	112.744	.1711
		979.78	.398	.3132			
12	.1669	56.41	.165	.1418	.1433	139.907	.1492
		1044.97	.339	.2910			

TABLE III

HS VG SHROUDED PROPELLER TEST

PERFORMANCE DATA

RUN 6 M = 0.10 THETA 3/4 = 22.00 DEG CONF L5 C1 E8 B3 PWT T1 R1 RE

PT	J	VO VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	.9149	113.27	-1.675	-.0102	.0056	.284	-.0715
		392.17	-13.367	-.0818			
3	.7833	113.27	.564	.0371	.0514	4.154	-.0399
		457.49	-.042	-.0027			
4	.6848	113.27	.584	.0646	.0757	9.112	-.0158
		522.68	.441	.0488			
5	.6082	113.27	.543	.0813	.0910	15.587	.0009
		587.87	.549	.0821			
6	.5466	113.27	.513	.0937	.0999	23.497	.0190
		653.45	.617	.1127			
7	.4976	113.37	.478	.1032	.1072	33.369	.0318
		717.72	.626	.1350			
8	.4553	113.37	.404	.1004	.1131	45.838	.0442
		783.82	.582	.1446			
9	.4196	113.37	.410	.1151	.1175	60.666	.0553
		849.53	.608	.1704			
10	.3893	113.37	.384	.1206	.1222	78.744	.0664
		914.72	.595	.1870			
11	.3631	113.37	.353	.1242	.1276	101.085	.0767
		979.91	.571	.2009			
12	.3400	113.37	.327	.1257	.1307	125.698	.0820
		1045.49	.540	.2077			
13	.3893	113.37	.382	.1206	.1227	79.076	.0662
		914.72	.592	.1869			

TABLE III

HS VG SHROUDED PROPELLER TEST

PERFORMANCE DATA

RUN 7 M = 0.02 T'ETA 3/4 = 29.00 DEG CONF L5 C1 E8 B3 PWT T1 R1 RE

PT	J	V0 VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	.1775	22.57	.152	.1919	.2232	11.542	.1938
		392.30	.306	.3857			
3	.1515	22.57	.130	.1930	.2250	18.440	.2097
		457.36	.271	.4027			
4	.1319	22.57	.104	.1774	.2248	27.542	.2201
		522.94	.233	.3975			
5	.1165	22.57	.101	.1964	.2266	39.538	.2387
		588.39	.223	.4351			
6	.1043	22.57	.089	.1963	.2283	54.601	.2554
		653.58	.206	.4517			
7	.0943	22.57	.081	.1983	.2298	73.101	.2646
		718.76	.190	.4630			
8	.0872	22.57	.074	.1996	.2329	96.311	.2715
		784.48	.176	.4711			
9	.0805	22.57	.068	.2020	.2375	124.626	.2721
		849.27	.160	.4742			
10	.0752	22.57	.063	.2064	.2458	161.143	-.0569
		914.72	.045	.1495			
11	.0698	22.57	.073	.2731	.2590	209.016	.2996
		980.30	.154	.5727			
12	.0654	22.57	.051	.2061	.2638	258.232	.2898
		1045.49	.123	.4959			
13	.1320	22.57	.102	.1767	.2283	27.901	.2226
		522.55	.231	.3993			
14	.0805	22.57	.068	.2016	.2380	124.973	.2707
		849.53	.159	.4723			

TABLE III

HS VG SHROUDED PROPELLER TEST

PERFORMANCE DATA

RUN 8 M = 0.05 THETA 3/4 = 29.00 DEG CONF L5 C1 E8 B3 PWT T1 R1 RE

PT	J	V0 VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	.4517	56.41	.383	.1711	.2015	10.398	.0899
		392.17	.585	.2610			
3	.3865	56.41	.323	.1764	.2109	17.282	.1120
		457.49	.528	.2883			
4	.3374	56.41	.300	.1908	.2143	26.206	.1330
		522.81	.509	.3238			
5	.2992	56.41	.257	.1865	.2170	37.828	.1533
		588.39	.468	.3398			
6	.2688	56.41	.230	.1890	.2206	52.702	.1687
		653.58	.435	.3577			
7	.2440	56.41	.210	.1925	.2237	70.987	.1827
		718.50	.409	.3752			
8	.2231	56.41	.190	.1942	.2271	93.716	.1978
		784.21	.385	.3920			
9	.2056	56.41	.173	.1969	.2331	122.140	.2089
		849.14	.357	.4058			
10	.1904	56.41	.143	.2070	.2549	205.428	.2406
		914.46	.336	.4274			
11	.1772	56.41	.143	.2070	.2549	205.428	.2406
		980.17	.311	.4476			
12	.1659	56.41	.129	.2027	.2592	253.232	.2374
		1045.23	.281	.4401			

TABLE III

HS VG SHROUDED PROPELLER TEST

PERFORMANCE DATA

RUN 9 M = 0.10 THETA 3/4 = 29.00 DEG CONF L5 C1 E8 B3 PWT T1 R1 RE

PT	J	VO VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	.9099	112.84	.592	.0795	.1222	6.265	-.0232
		392.04	.419	.0563			
3	.7796	112.95	.562	.1179	.1635	13.294	-.0008
		457.49	.558	.1170			
4	.6812	112.95	.518	.1392	.1830	22.223	.0304
		522.94	.631	.1697			
5	.6054	113.06	.475	.1526	.1944	33.546	.0513
		588.26	.635	.2039			
6	.5446	113.06	.435	.1590	.1988	46.986	.0686
		653.31	.623	.2276			
7	.4940	112.95	.400	.1643	.2028	63.964	.0852
		718.76	.607	.2495			
8	.4527	113.06	.368	.1707	.2097	85.740	.1012
		784.21	.587	.2719			
9	.4174	113.06	.338	.1768	.2178	113.265	.1176
		849.66	.564	.2944			
10	.3875	113.16	.313	.1840	.2277	147.542	.1336
		914.85	.540	.3176			
11	.3613	113.16	.285	.1900	.2405	191.492	.1486
		979.91	.508	.3386			
12	.3385	113.16	.259	.1877	.2448	236.527	.1526
		1045.23	.470	.3403			
13	.6064	113.16	.474	.1524	.1950	33.524	.0502
		587.87	.630	.2026			

TABLE III

HS VG SHROUDED PROPELLER TEST

PERFORMANCE DATA

RUN 11 M = 0.10 THETA 3/4 = 36.00 DEG CONF L5 C1 E8 B3 PWT T1 R1 RE

PT	J	V0 VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	.9075	112.74	.506	.1757	.3146	16.182	.0096
		392.17	.534	.1854			
3	.7780	112.84	.496	.1900	.2978	24.254	.0448
		457.36	.613	.2348			
4	.6797	112.84	.450	.2067	.3122	37.980	.0785
		522.81	.621	.2852			
5	.6039	112.95	.407	.2198	.3261	56.409	.1075
		588.26	.606	.3274			
6	.5428	112.95	.364	.2273	.3381	80.257	.1322
		653.71	.577	.3595			
7	.4931	112.95	.332	.2362	.3501	110.415	.1573
		718.63	.554	.3935			
8	.4512	112.95	.302	.2440	.3634	149.001	.1790
		784.35	.525	.4230			
9	.4159	112.95	.275	.2553	.3850	200.574	.2041
		849.53	.496	.4594			
10	.3861	113.06	.249	.2697	.4167	270.455	.2317
		914.72	.464	.5014			
11	.3600	113.06	.225	.2681	.4283	341.650	.2399
		979.78	.427	.5080			
12	.3373	113.06	.204	.2585	.4270	413.397	.2390
		1045.10	.392	.4974			
13	.6055	113.16	.401	.2192	.3303	56.799	.1059
		587.87	.596	.3251			

TABLE III

HS VG SHROUDED PROPELLER TEST

PERFORMANCE DATA

RUN 12 M = 0.05 THETA 3/4 = 36.00 DEG CONF L5 C1 E8 B3 PWT T1 R1 RE

PT	J	VO VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	.4507	56.41	.313	.2356	.3392	17.527	.1532
		392.30	.516	.3888			
3	.3857	56.41	.270	.2430	.3470	28.407	.1836
		457.36	.474	.4266			
4	.3366	56.41	.235	.2480	.3541	43.297	.2100
		522.81	.435	.4580			
5	.2983	56.41	.208	.2523	.3603	62.847	.2343
		588.52	.402	.4866			
6	.2680	56.41	.185	.2536	.3667	87.600	.2540
		653.58	.371	.5076			
7	.2430	56.41	.167	.2575	.3738	118.790	.2772
		718.76	.347	.5347			
8	.2222	56.41	.151	.2627	.3854	158.893	.2938
		783.95	.321	.5566			
9	.2045	56.41	.137	.2736	.4064	213.226	.3184
		849.53	.297	.5920			
10	.1894	56.41	.123	.2864	.4376	286.321	.3450
		914.46	.273	.6314			
11	.1765	56.46	.111	.2808	.4441	357.048	.3448
		980.04	.248	.6256			
12	.1653	56.46	.101	.2692	.4404	429.340	.3352
		1045.10	.226	.6044			

TABLE III

HS VG SHROUDED PROPELLER TEST

PERFORMANCE DATA

RUN 13 M = 0.02 THETA 3/4 = 36.00 DEG CONF L5 C1 E8 B3 PWT T1 R1 RE

PT	J	V0 VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	.1764	22.53	.124	.2535	.3593	18.673	.2693
		392.43	.256	.5228			
3	.1502	22.53	.123	.2962	.3617	29.728	.3083
		457.23	.251	.6045			
4	.1308	22.53	.092	.2588	.3665	44.995	.3262
		522.68	.208	.5851			
5	.1155	22.53	.081	.2593	.3699	64.745	.3331
		588.26	.185	.5924			
6	.1045	22.53	.072	.2594	.3731	89.463	.3556
		653.31	.172	.6150			
7	.0950	22.53	.065	.2604	.3797	121.096	.3638
		718.50	.156	.6243			
8	.0870	22.53	.059	.2660	.3893	161.537	.3794
		784.35	.144	.6454			
9	.0803	22.53	.054	.2769	.4092	215.695	.3923
		849.53	.131	.6692			
10	.0746	22.53	.048	.2877	.4390	289.144	.4081
		914.98	.118	.6958			

RUN 14 M = 0.20 THETA 3/4 = 36.00 DEG CONF L5 C1 E8 B3 PWT T1 R1 RE

PT	J	V0 VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	1.3714	226.48	.652	.0428	.0899	10.634	-.1478
		522.81	-1.600	-.1050			
3	1.0930	225.85	.618	.1250	.2210	51.247	-.0503
		653.18	.369	.0747			
4	.9137	226.90	.548	.1696	.2824	112.212	.0009
		784.08	.551	.1706			
5	.7821	226.90	.471	.1982	.3287	207.297	.0591
		914.59	.612	.2574			
6	.6837	226.90	.390	.2000	.3505	329.923	.0821
		1045.23	.550	.2821			

TABLE III

HS VG SHROUDED PROPELLER TEST

PERFORMANCE DATA

RUN 29 M = 0.20 THETA 3/4 = 20.00 DEG CONF L4 C1 E7 B3 PWT T1 R1 RE

PT	J	VC VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	1.4393	224.79	2.305	-.0387	-.0242	-2.572	.0037
		505.83	2.081	-.0350			
3	1.2941	224.79	.485	.0080	.0213	3.101	.0015
		561.74	.578	.0095			
4	1.2364	224.79	.805	.0220	.0338	5.634	-.0004
		587.60	.789	.0216			
5	1.1110	224.79	.912	.0521	.0634	14.514	-.0024
		652.92	.869	.0496			
6	1.0087	225.00	.918	.0791	.0870	26.458	-.0031
		718.37	.881	.0760			
7	.9220	225.00	.921	.1118	.1118	44.179	-.0004
		783.69	.918	.1113			
8	.8495	225.00	.869	.1253	.1225	61.482	.0007
		848.88	.874	.1260			
9	.7866	225.00	.816	.1406	.1355	85.033	.0032
		914.46	.834	.1438			
10	.7317	225.00	.774	.1586	.1498	115.780	.0086
		980.17	.816	.1672			
11	.6847	225.00	.715	.1641	.1570	147.043	.0122
		1044.97	.768	.1763			

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TABLE III

HS VG SHROUDED PROPELLER TEST

PERFORMANCE DATA

RUN 30 M = 0.20 THETA 3/4 = 30.00 DEG CONF L4 C1 E7 B3 PWT T1 R1 RE

PT	J	VO VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	1.7955	224.79	.839	.0191	.0410	2.235	-.0004
		404.64	.822	.0188			
3	1.5868	224.79	1.041	.0840	.1280	10.067	-.0046
		457.36	.983	.0793			
4	1.3864	224.79	1.008	.1410	.1940	22.727	-.0046
		522.29	.975	.1365			
5	1.2294	224.79	.956	.1718	.2210	36.890	-.0021
		587.73	.944	.1697			
6	1.1038	224.79	.880	.1880	.2356	54.010	-.0002
		653.31	.880	.1878			
7	1.0013	224.79	.820	.2073	.2529	77.080	.0038
		718.37	.836	.2111			
8	.9153	224.79	.759	.2239	.2699	106.879	.0076
		783.82	.784	.2314			
9	.8421	224.79	.703	.2441	.2920	147.084	.0152
		849.27	.747	.2593			
10	.7790	224.79	.647	.2679	.3223	202.713	.0255
		914.59	.709	.2934			
11	.7246	224.79	.585	.2847	.3523	272.466	.0337
		979.78	.654	.3184			
12	.6777	224.79	.527	.2789	.3582	336.731	.0341
		1045.62	.592	.3130			

TABLE III

HS VG SHROUDED PROPELLER TEST

PERFORMANCE DATA

RUN 32 M = 0.40 THETA 3/4 = 36.00 DEG CONF L4 C1 E7 B3 PWT T1 R1 RE

PT	J	V0 VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	2.3151	448.91	15.470	.0163	.0024	.455	.0056
		627.06	20.769	.0219			
3	2.2255	449.74	.997	.0420	.0938	19.696	.0023
		653.31	1.051	.0443			
5	1.8540	450.57	1.086	.1644	.2805	101.373	-.0093
		783.95	1.024	.1550			
6	1.7098	450.57	1.010	.1968	.3332	152.983	-.0093
		849.14	.962	.1876			
8	1.4788	450.98	.881	.2481	.4162	293.367	-.0025
		980.17	.873	.2457			
9	1.3855	450.98	.822	.2576	.4339	370.926	-.0047
		1045.23	.807	.2529			
10	2.0265	450.98	1.060	.1066	.2038	56.653	-.0061
		718.76	.998	.1004			
11	1.5884	451.40	.957	.2288	.3795	216.931	-.0088
		914.59	.920	.2199			

RUN 33 M = 0.20 THETA 3/4 = 40.00 DEG CONF L4 C1 E7 B3 PWT T1 R1 RE

PT	J	V0 VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	1.8532	225.43	1.013	.2063	.3771	18.660	-.0137
		392.17	.946	.1926			
3	1.5858	225.43	.924	.2432	.4170	32.727	-.0074
		457.36	.896	.2358			
4	1.3860	225.64	.829	.2740	.4581	53.525	-.0011
		522.55	.825	.2729			
5	1.2308	225.64	.722	.2876	.4904	81.246	.0045
		587.08	.733	.2922			
6	1.1038	225.64	.615	.2850	.5114	116.753	.0102
		653.31	.637	.2952			
7	1.0020	225.64	.544	.2790	.5134	155.750	.0147
		718.24	.573	.2937			
8	.9166	225.85	.487	.2777	.5218	205.662	.0200
		784.21	.522	.2977			
9	.8440	225.85	.440	.2720	.5211	261.485	.0246
		849.93	.480	.2966			
10	.7822	225.85	.402	.2713	.5273	329.976	.0309
		914.85	.448	.3023			
11	.7284	225.85	.371	.2735	.5369	412.882	.0347
		979.91	.418	.3083			

TABLE III

HS VG SHROUDED PROPELLER TEST

PERFORMANCE DATA

RUN 34 M = 0.40 THETA 3/4 = 43.00 DEG CONF L4 C1 E7 B3 PWT T1 R1 RE

PT	J	V0 / 0T	ETA / T / 0	CT / 3T / 0	CP	HP	CC
2	2.9158	447.67	1.100	.0529	.1403	13.163	.0040
		496.42	1.184	.0570			
3	2.7722	448.50	1.088	.0874	.2225	24.313	.0004
		522.94	1.093	.0878			
4	2.4659	448.91	.986	.1498	.3746	58.093	-.0074
		588.00	.937	.1424			
5	2.2182	449.33	1.046	.2119	.4490	95.434	-.0109
		653.58	.992	.2009			
6	1.8488	450.16	.927	.2908	.5799	211.823	-.0116
		783.82	.890	.2792			
8	1.7050	450.57	.852	.3237	.6474	300.553	-.0091
		849.53	.828	.3145			
9	1.5818	450.57	.775	.3240	.6609	383.144	-.0056
		914.85	.761	.0318			
10	2.4743	450.57	1.081	.1630	.3731	57.465	-.0122
		588.13	1.000	.1508			

RUN 35 M = 0.40 THETA 3/4 = 50.00 DEG CONF L4 C1 E7 B3 PWT T1 R1 RE

PT	J	V0 / VT	ETA / ETA NET	CT / CT NET	CP	HP	CC
2	3.7084	449.74	1.045	.0622	.2204	10.113	.0051
		392.17	1.132	.0673			
3	3.1793	450.16	1.095	.1835	.5326	38.718	-.0074
		457.49	1.051	.1761			
4	2.7881	451.40	.972	.2264	.6494	70.073	-.0134
		522.81	.914	.2130			
5	2.4771	451.81	.987	.2869	.7197	110.493	-.0158
		588.39	.933	.2711			
6	2.2262	451.81	.899	.3140	.7772	163.936	-.0159
		654.10	.854	.2981			
7	2.0250	451.81	.794	.3088	.7867	220.048	-.0126
		718.63	.762	.2961			
8	1.8576	452.22	.688	.2818	.7607	275.598	-.0110
		783.82	.661	.2708			
9	1.7136	452.22	.608	.2666	.7504	345.808	-.0089
		849.27	.588	.2577			
10	2.7945	452.63	.962	.2228	.6470	69.538	-.0184
		523.07	.882	.2043			
11	2.7954	452.63	1.053	.2435	.6459	69.313	-.0164
		522.81	.982	.2271			

TABLE III

HS VG SHROUDED PROPELLER TEST

PERFORMANCE DATA

RUN 36 M = 0.40 THETA 3/4 = 50.00 DEG CONF L4 C1 E7 B3 PWT T1 R1 RE

PT	J	V0 VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	3.7013	449.33	1.041	.0634	.2255	10.409	.0053
		392.56	1.128	.0687			
3	2.7774	449.74	1.057	.2438	.6403	69.693	-.0130
		522.81	1.001	.2308			
4	2.2243	450.98	.899	.3144	.7771	164.247	-.0150
		653.45	.001	.2994			
5	1.8519	450.98	.683	.2794	.7565	276.259	-.0098
		784.08	.660	.2696			
6	2.7856	451.40	1.050	.2449	.6493	70.315	-.0150
		523.20	.986	.2299			

RUN 37 M = 0.60 THETA 3/4 = 50.00 DEG CONF L4 C1 E7 B3 PWT T1 R1 RE

PT	J	V0 VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	3.6817	669.80	1.028	.0698	.2498	34.401	.0171
		588.26	1.280	.0869			
3	3.3108	669.20	1.095	.1771	.5352	101.071	-.0045
		653.18	1.067	.1726			
4	3.0084	669.20	1.067	.2498	.7042	176.914	-.0115
		718.37	1.018	.2383			

TABLE III

HS VG SHROUDED PROPELLER TEST

PERFORMANCE DATA

RUN 39 M = 0.20 THETA 3/4 = 22.00 DEG CONF L4 C1 E7 B3 PNT T2 R1 RE

PT	J	V0 VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	1.2660	224.37	.340	.0085	.0317	4.928	.0002
		573.09	.350	.0088			
3	1.1123	224.37	.803	.0471	.0652	14.852	-.0026
		651.09	.759	.0445			
4	1.0086	224.37	.905	.0842	.0938	28.447	-.0021
		716.20	.882	.0821			
5	.9225	224.37	.887	.1049	.1090	42.941	-.0008
		781.44	.880	.1041			
6	.8496	224.37	.847	.1209	.1212	60.718	.0005
		846.68	.851	.1214			
7	.7873	224.37	.806	.1364	.1332	83.227	.0034
		911.40	.826	.1398			
8	.7328	224.37	.760	.1480	.1426	109.698	.0068
		976.77	.795	.1548			
9	.6856	224.37	.708	.1544	.1493	139.393	.0099
		1041.75	.754	.1643			

TABLE III

HS VG SHROUDED PROPELLER TEST

PERFORMANCE DATA

RUN 40 M = 0.20 THETA 3/4 = 30.00 DEG CONF L4 C1 E7 B3 PNT T2 R1 RE

PT	J	V0 VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	1.7143	224.37	.686	.0201	.0503	3.146	-.0016
		423.21	.632	.0186			
3	1.5905	224.37	.971	.0655	.1073	8.368	-.0035
		455.63	.919	.0620			
4	1.3891	224.37	.975	.1149	.1637	19.051	-.0058
		520.74	.926	.1091			
5	1.2312	224.37	.941	.1572	.2056	34.129	-.0036
		586.11	.920	.1536			
6	1.1060	224.37	.885	.1762	.2202	50.108	-.0007
		651.09	.881	.1755			
7	1.0029	224.37	.833	.1972	.2373	71.874	.0038
		716.20	.849	.2010			
8	.9170	224.37	.774	.2118	.2509	98.696	.0067
		781.44	.798	.2186			
9	.8439	224.37	.724	.2304	.2682	134.127	.0142
		846.55	.769	.2446			
10	.7808	224.37	.672	.2516	.2921	182.448	.0235
		911.66	.735	.2751			
11	.7262	224.37	.612	.2733	.3242	248.873	.0347
		976.51	.689	.3079			
12	.6795	224.37	.551	.2683	.3304	307.826	.0338
		1041.62	.621	.3021			

TABLE III

HS VG SHROUDED PROPELLER TEST

PERFORMANCE DATA

RUN 41 M = 0.40 THETA 3/4 = 32.00 DEG CONF L4 C1 E7 B3 PNT T2 R1 RE

PT	J	V0 VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	1.8939	443.49	.522	.0148	.0538	18.156	.0028
		757.22	.619	.0176			
3	1.8450	446.00	.796	.0343	.0796	29.159	.0006
		781.44	.810	.0349			
4	1.7064	447.25	.968	.0814	.1434	66.375	-.0038
		846.42	.923	.0776			
5	1.5839	447.67	.991	.1234	.1971	113.814	-.0063
		911.66	.941	.1171			
6	1.4769	447.67	.949	.1439	.2239	159.030	-.0066
		976.77	.906	.1374			
7	1.3832	447.67	.886	.1592	.2485	214.230	-.0066
		1042.01	.849	.1525			

RUN 42 M = 0.20 THETA 3/4 = 40.00 DEG CONF L4 C1 E7 B3 PNT T2 R1 RE

PT	J	V0 VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	2.3530	224.37	.900	.0460	.1201	2.899	-.0131
		308.35	.643	.0328			
3	1.8525	224.37	.996	.1828	.3399	16.683	-.0160
		390.65	.909	.1668			
4	1.5843	224.37	.931	.2217	.3770	29.404	-.0100
		455.89	.889	.2117			
5	1.3849	224.58	.852	.2598	.4220	48.957	-.0039
		520.74	.839	.2559			
6	1.2273	224.58	.766	.2833	.4534	75.008	.0016
		586.11	.771	.2850			
7	1.1032	224.79	.673	.2942	.4819	109.090	.0082
		651.09	.692	.3024			
8	1.0004	224.79	.588	.2934	.4988	150.353	.0155
		716.33	.619	.3090			
9	.9149	224.79	.526	.2953	.5135	200.833	.0230
		781.31	.567	.3183			
10	.8424	224.79	.476	.2950	.5218	259.618	.0272
		846.55	.520	.3222			
11	.7804	224.79	.433	.2955	.5324	330.698	.0339
		911.53	.482	.3294			
12	.7279	225.21	.398	.2981	.5445	414.393	.0381
		976.64	.449	.3362			

TABLE III

HS VG SHROUDED PROPELLER TEST

PERFORMANCE DATA

RUN 43 M = 0.40 THETA 3/4 = 43.00 DEG CONF L4 C1 E7 B3 PNT T2 R1 RE

PT	J	V0 VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	2.7418	447.25	.727	.0319	.1202	13.455	.0020
		527.51	.773	.0339			
3	2.4673	447.67	1.037	.1142	.2715	41.657	-.0061
		586.24	.981	.1080			
4	2.2189	447.67	1.022	.1793	.3893	81.870	-.0103
		651.22	.963	.1690			
5	2.0156	448.08	.999	.2189	.4414	123.557	-.0113
		716.85	.947	.2075			
6	1.8473	448.08	.955	.2544	.4917	178.227	-.0116
		781.31	.912	.2428			
7	1.7018	448.08	.896	.3082	.5853	269.963	-.0080
		846.68	.873	.3002			
8	1.5802	448.50	.817	.3264	.6308	362.386	-.0041
		911.53	.807	.3223			
9	1.5247	448.50	.778	.3270	.6401	408.755	-.0030
		944.21	.771	.3239			
10	1.8478	448.50	.954	.2541	.4920	178.346	-.0124
		781.83	.907	.2417			

RUN 44 M = 0.60 THETA 3/4 = 43.00 DEG CONF L4 C1 E7 B3 PNT T2 R1 RE

PT	J	V0 VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	2.7385	661.93	.806	.0390	.1324	43.290	.0061
		781.57	.932	.0451			
3	2.5335	663.75	.990	.0951	.2433	100.580	.0005
		846.68	.995	.0956			
4	2.3540	664.36	.977	.1293	.3114	160.456	-.0040
		911.66	.947	.1253			
5	2.1983	664.97	.914	.1530	.3676	232.393	-.0065
		976.64	.875	.1464			
6	2.0614	665.57	.726	.1693	.4805	368.315	-.0087
		1042.01	.688	.1606			
7	2.5165	659.49	.979	.0934	.2400	100.611	-.0020
		846.94	.957	.0914			

TABLE III

HS VG SHROUDED PROPELLER TEST

PERFORMANCE DATA

RUN 45 M = 0.40 THETA 3/4 = 49.00 DEG CONF L4 C1 E7 B3 PNT T2 R1 RE

PT	J	V0 VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	3.1725	447.67	1.029	.1100	.3389	24.434	-.0070
		456.15	.964	.1030			
3	2.7744	447.67	1.051	.2042	.5388	57.919	-.0150
		521.13	.974	.1892			
4	2.4667	448.08	1.016	.2450	.5944	90.791	-.0164
		586.24	.948	.2286			
5	2.2182	448.08	.956	.2907	.6743	141.196	-.0151
		651.22	.906	.2756			
6	2.0159	448.50	.891	.3345	.7564	210.390	-.0129
		716.33	.857	.3216			
7	1.8482	448.50	.864	.3805	.8133	292.241	-.0096
		780.14	.843	.3710			
8	1.7039	448.50	.694	.3013	.7398	339.638	-.0084
		846.55	.674	.2930			
9	1.6285	448.91	.688	.3156	.7469	392.216	-.0073
		885.88	.672	.3083			
10	2.2236	449.33	.955	.2910	.6775	141.252	-.0184
		651.48	.894	.2726			

RUN 46 M = 0.60 THETA 3/4 = 49.00 DEG CONF L4 C1 E7 B3 PNT T2 R1 RE

PT	J	V0 VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	3.2945	663.75	.987	.0883	.2946	55.303	.0060
		651.35	1.054	.0943			
3	2.9971	664.36	1.042	.1742	.5008	124.749	-.0044
		716.20	1.016	.1698			
4	2.7477	664.97	1.015	.2281	.6172	199.329	-.0106
		781.44	.968	.2174			
5	2.5354	664.97	.949	.2555	.6824	280.058	-.0136
		846.42	.898	.2419			
6	2.3522	664.97	.871	.2685	.7245	371.846	-.0143
		911.92	.825	.2542			
7	2.2869	664.97	.836	.2679	.7322	408.727	-.0146
		937.83	.791	.2533			

TABLE III

HS VG SHROUDED PROPELLER TEST

PERFORMANCE DATA

RUN 47 M = 0.60 THETA 3/4 = 54.00 DEG CONF L4 C1 E7 B3 PNT T2 R1 RE

PT	J	V0 VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	4.0116	662.54	.952	.0921	.3880	40.281	.0098
		534.02	1.053	.1019			
3	3.6585	663.75	1.055	.1814	.6288	86.110	-.0010
		586.37	1.050	.1805			
4	3.2959	664.36	1.034	.2606	.8304	155.403	-.0095
		651.09	.996	.2511			
5	2.9922	664.36	1.015	.3158	.9301	232.182	-.0153
		716.72	.966	.3004			
6	2.7432	664.97	.911	.3408	1.0264	332.302	-.0206
		782.09	.855	.3202			

RUN 48 M = 0.20 THETA 3/4 = 30.00 DEG CONF L4 C1 E7 B3 PNT T2 R1 RE

PT	J	V0 VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	1.6055	226.48	.889	.0472	.0852	6.478	-.0059
		455.89	.777	.0413			
3	1.4009	226.48	.985	.1116	.1587	18.045	-.0053
		521.26	.938	.1064			
4	1.2435	226.48	.951	.1507	.1970	31.816	-.0043
		585.98	.924	.1464			
5	1.1167	226.48	.896	.1737	.2164	47.925	-.0013
		651.09	.890	.1725			
6	1.0119	226.27	.832	.1874	.2279	67.345	.0023
		716.33	.842	.1897			
7	.9254	226.27	.782	.2059	.2435	93.384	.0059
		781.31	.805	.2119			
8	.8512	226.27	.737	.2261	.2610	127.442	.0134
		846.81	.781	.2395			
9	.7873	226.06	.683	.2459	.2820	172.058	.0219
		911.53	.744	.2668			
10	.7322	226.06	.625	.2654	.3107	233.105	.0319
		976.64	.700	.2973			
11	.6848	226.06	.565	.2680	.3247	295.717	.0333
		1041.75	.635	.3013			
12	1.6023	226.06	.841	.0469	.0892	6.811	-.0021
		455.89	.803	.0447			

TABLE III

HS VG SHROUDED PROPELLER TEST

PERFORMANCE DATA

RUN 61 M = 0.20 THETA 3/4 = 22.00 DEG CONF L4 C1 E6 B3 PNT T2 R1 RE

PT	J	V0 VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	1.4003	225.64	.363	.0089	.0343	3.988	-.0075
		521.26	.056	.0014			
3	1.2420	225.64	.988	.0596	.0749	12.395	-.0074
		586.50	.864	.0522			
4	1.1161	225.64	1.030	.0909	.0984	22.315	-.0108
		651.48	.907	.0800			
5	1.0134	225.64	1.012	.1151	.1153	34.710	-.0135
		716.20	.893	.1016			
6	.9270	225.64	.973	.1330	.1267	49.547	-.0138
		781.44	.872	.1191			
7	.8534	225.64	.927	.1488	.1370	68.206	-.0127
		846.94	.847	.1360			
8	.7906	225.64	.876	.1634	.1475	91.728	-.0107
		912.05	.818	.1528			
9	.7363	225.64	.827	.1746	.1555	118.929	-.0091
		977.16	.783	.1655			
10	.6884	225.64	.769	.1842	.1648	153.098	-.0057
		1042.53	.745	.1785			
11	1.3182	225.85	.833	.0395	.0625	8.673	-.0042
		553.56	.744	.0353			

TABLE III

HS VG SHROUDED PROPELLER TEST

PERFORMANCE DATA

RUN 62 M = 0.20 THETA 3/4 = 28.00 DEG CONF L4 C1 E6 B3 PNT T2 R1 RE

PT	J	V0 VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	1.8558	223.94	.000	.0000	.0231	1.138	-.0187
		390.52	-1.502	-.0187			
3	1.5868	223.94	1.124	.0800	.1130	8.835	-.0099
		455.76	.984	.0701			
4	1.3871	224.15	1.120	.1353	.1675	19.512	-.0172
		520.87	.978	.1182			
5	1.2307	224.15	1.068	.1641	.1890	31.346	-.0199
		585.98	.938	.1441			
6	1.1060	224.15	1.000	.1798	.1988	45.212	-.0203
		650.96	.887	.1595			
7	1.0029	224.15	.935	.1996	.2139	64.775	-.0189
		716.20	.847	.1806			
8	.9170	224.15	.876	.2175	.2275	89.455	-.0162
		781.31	.811	.2013			
9	.8443	224.15	.820	.2346	.2414	120.640	-.0122
		846.29	.777	.2223			
10	.7813	224.15	.764	.2558	.2615	163.289	-.0070
		911.53	.743	.2489			
11	.7268	224.15	.697	.2764	.2881	221.189	-.0009
		976.51	.694	.2754			
12	.6794	224.15	.628	.2786	.3014	281.023	.0060
		1041.88	.641	.2847			

TABLE III

HS VG SHROUDED PROPELLER TEST

PERFORMANCE DATA

RUN 63 M = 0.40 THETA 3/4 = 30.00 DEG CONF L4 C1 E6 B3 PNT T2 R1 RE

PT	J	V0 VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	2.0120	445.17	.686	.0175	.0512	14.450	-.0270
		715.81	-.376	-.0096			
3	1.8481	446.84	1.131	.0724	.1183	43.104	-.0187
		781.31	.838	.0536			
4	1.7059	447.25	1.173	.1162	.1689	78.083	-.0161
		846.29	1.011	.1001			
5	1.5806	446.84	1.158	.1533	.2091	121.039	-.0204
		911.53	1.004	.1329			
6	1.4763	447.67	1.109	.1776	.2365	167.786	-.0243
		976.77	.957	.1534			
7	1.3830	447.67	1.036	.1924	.2568	221.085	-.0262
		1041.75	.895	.1662			

RUN 64 M = 0.40 THETA 3/4 = 41.00 DEG CONF L4 C1 E6 B3 PNT T2 R1 RE

PT	J	V0 VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	2.7746	446.84	1.144	.0650	.1575	17.006	-.0489
		520.87	.283	.0161			
3	2.4745	448.08	1.229	.1516	.3052	46.434	-.0381
		585.07	.920	.1135			
4	2.2215	448.08	1.195	.2007	.3728	78.152	-.0317
		651.09	1.007	.1690			
5	2.0188	448.50	1.154	.2350	.4110	114.613	-.0324
		716.46	.995	.2026			
6	1.8493	448.50	1.099	.2752	.4629	167.408	-.0388
		781.31	.944	.2364			
7	1.7039	448.50	1.029	.3204	.5303	244.145	-.0436
		846.81	.889	.2767			
8	1.5811	448.50	.941	.3455	.5802	333.042	-.0444
		911.40	.820	.3012			
9	1.4735	448.50	.853	.3458	.5970	422.178	-.0419
		977.03	.749	.3038			

TABLE III

HS VG SHROUDED PROPELLER TEST

PERFORMANCE DATA

RUN 65 M = 0.60 THETA 3/4 = 41.00 DEG CONF L4 C1 E6 B3 PNT T2 R1 RE

PT	J	V0 VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	2.8493	665.57	1.043	.0527	.1440	42.137	-.0788
		755.79	-.516	-.0261			
3	2.7613	666.79	1.150	.0821	.1972	63.468	-.0743
		781.05	.109	.0078			
4	2.5506	667.99	1.232	.1574	.3258	132.935	-.0659
		846.42	.715	.0914			
5	2.3680	668.60	1.195	.1979	.3921	199.713	-.0600
		911.92	.832	.1379			
6	2.2096	668.60	1.129	.2277	.4455	278.729	-.0535
		976.64	.863	.1742			
7	2.0718	669.20	1.045	.2425	.4805	364.518	-.0519
		1042.01	.821	.1905			

RUN 66 M = 0.40 THETA 3/4 = 47.00 DEG CONF L4 C1 E6 B3 PNT T2 R1 RE

PT	J	V0 VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	3.6330	448.50	1.083	.0658	.2207	10.653	-.0888
		399.38	-.378	-.0230			
3	3.1802	448.50	1.231	.1701	.4396	31.564	-.0660
		455.89	.753	.1041			
4	2.7797	448.50	1.210	.2365	.5432	58.261	-.0515
		521.13	.946	.1850			
5	2.4698	448.50	1.145	.2843	.6131	93.484	-.0430
		585.98	.972	.2413			
6	2.2204	448.50	1.046	.3160	.6705	140.342	-.0454
		651.22	.896	.2706			
7	2.0173	448.50	.916	.3139	.6910	192.483	-.0432
		716.33	.790	.2707			
8	1.8484	448.50	.811	.3068	.6992	252.707	-.0405
		781.31	.703	.2662			
9	1.7050	448.50	.728	.3038	.7108	326.632	-.0375
		846.42	.638	.2662			
10	1.6063	448.50	.674	.3020	.7192	394.510	-.0365
		897.86	.593	.2656			

TABLE III

HS VG SHROUDED PROPELLER TEST

PERFORMANCE DATA

RUN 67 M = 0.60 THETA 3/4 = 47.00 DEG CONF L4 C1 E6 B3 PNT T2 R1 RE

PT	J	V0 VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	3.6719	664.97 585.98	1.105 -.886	.0749 -.0600	.2488	33.994	-.1349
3	3.3185	667.99 650.96	1.215 .348	.1610 .0462	.4396	81.600	-.1148
4	3.0161	668.60 716.33	1.231 .751	.2429 .1483	.5950	146.907	-.0946
5	2.7661	669.20 781.31	1.197 .841	.2854 .2007	.6594	210.855	-.0847
6	2.5536	669.80 846.29	1.126 .872	.3530 .2735	.8004	324.669	-.0795
7	2.4470	670.41 883.66	1.072 .843	.3622 .2849	.8264	380.932	-.0772

RUN 68 M = 0.60 THETA 3/4 = 52.00 DEG CONF L4 C1 E6 B3 PNT T2 R1 RE

PT	J	V0 VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	4.1468	667.99 521.13	1.214 -.241	.1453 -.0288	.4959	47.209	-.1741
3	3.6890	668.60 585.98	1.245 .535	.2476 .1065	.7334	99.078	-.1411
4	3.3293	670.41 650.70	1.217 .736	.2940 .1779	.8042	147.959	-.1161
5	3.0210	670.41 716.59	1.152 .818	.3564 .2531	.9348	229.685	-.1033
6	2.7718	671.01 781.18	1.067 .822	.3975 .3062	1.0320	327.929	-.0913

TABLE III

HS VG SHROUDED PROPELLER TEST

PERFORMANCE DATA

RUN 69 M = 0.60 THETA 3/4 = 38.00 DEG CONF L4 C1 E6 B3 PNT T2 R1 RE

PT	J	VO VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	2.7064	664.97	1.006	.0435	.1171	39.861	-.0695
		794.98	-.600	-.0260			
3	2.5443	666.18	1.189	.0976	.2088	85.524	-.0648
		846.68	.398	.0327			
4	2.4522	666.79	1.209	.1259	.2554	116.844	-.0623
		878.98	.610	.0636			
5	2.3671	667.39	1.206	.1455	.2855	145.224	-.0586
		911.14	.720	.0869			
6	2.2860	667.99	1.198	.1678	.3201	180.724	-.0557
		943.95	.801	.1121			
7	2.2100	668.60	1.164	.1813	.3441	215.041	-.0524
		977.03	.827	.1288			
8	2.0752	669.80	1.085	.2027	.3875	292.528	-.0488
		1041.75	.824	.1539			

RUN 70 M = 0.20 THETA 3/4 = 38.00 DEG CONF L4 C1 E6 B3 PNT T2 R1 RE

PT	J	VO VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	1.8805	227.74	1.123	.2014	.3372	16.000	-.0343
		390.65	.931	.1671			
3	1.6056	227.32	1.042	.2420	.3726	28.208	-.0371
		455.89	.882	.2049			
4	1.4019	227.32	.943	.2759	.4100	46.324	-.0369
		521.00	.817	.2390			
5	1.2414	226.90	.828	.2934	.4397	70.935	-.0314
		585.98	.739	.2620			
6	1.1140	226.90	.715	.2978	.4639	102.909	-.0254
		651.61	.654	.2725			
7	1.0104	226.69	.632	.2997	.4788	141.296	-.0192
		716.20	.591	.2805			
8	.9231	226.48	.568	.3012	.4895	187.907	-.0120
		781.31	.545	.2892			
9	.8501	226.48	.515	.3022	.4990	243.539	-.0067
		846.42	.503	.2955			
10	.7869	226.27	.469	.3022	.5070	309.462	-.0014
		911.40	.466	.3008			
11	.7327	226.27	.431	.3020	.5125	384.803	.0044
		976.51	.438	.3065			
12	.7006	226.27	.409	.3037	.5202	444.254	.0083
		1019.35	.420	.3121			

TABLE III

HS VG SHROUDED PROPELLER TEST

PERFORMANCE DATA

RUN 71 M = 0.20 THETA 3/4 = 28.00 DEG CONF L4 C1 E6 B3 PNT T2 R1 RE

PT	J	V0 VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	1.7742	225.21	.834	.0270	.0574	3.231	-.0172
		410.58	.303	.0098			
3	1.5979	225.43	1.120	.0803	.1146	8.799	-.0113
		455.63	.961	.0689			
4	1.3971	225.64	1.107	.1331	.1679	19.198	-.0175
		520.61	.961	.1155			
5	1.2389	225.64	1.067	.1665	.1933	31.517	-.0209
		585.98	.933	.1456			
6	1.1128	225.64	.999	.1824	.2031	45.467	-.0208
		651.22	.885	.1616			
7	1.0098	225.64	.934	.2017	.2180	64.868	-.0195
		716.07	.844	.1822			
8	.9229	225.64	.878	.2213	.2327	89.982	-.0167
		781.44	.811	.2046			
9	.8495	225.64	.820	.2378	.2462	121.128	-.0133
		846.68	.774	.2245			
10	.7865	225.64	.762	.2577	.2659	163.313	-.0087
		911.66	.736	.2490			
11	.7308	225.43	.697	.2811	.2945	222.784	-.0006
		976.64	.695	.2805			
12	.6828	225.21	.627	.2817	.3064	281.823	.0038
		1041.75	.636	.2855			

RUN 88 M = 0.40 THETA 3/4 = DEG CONF PTR + B3 PNT T1 R1 RE5 RE

PT	J	V0 VT	ETA ETA NET	CT CT NET	CP	HP	CC
2	2.4881	451.40	.801	.0370	.1149	17.528	.0
		586.63	.801	.0370			
3	2.2388	451.40	.922	.1017	.2467	51.505	.0
		651.35	.922	.1017			
4	2.0341	451.40	.931	.1524	.3328	92.388	.0
		716.20	.931	.1524			
5	1.8628	451.40	.903	.1843	.3800	136.944	.0
		781.31	.903	.1843			
6	1.7178	451.40	.873	.2071	.4073	186.602	.0
		846.42	.873	.2071			
7	1.5930	451.40	.833	.2416	.4620	264.399	.0
		911.53	.833	.2416			
8	1.4840	451.40	.770	.2751	.5300	373.473	.0
		977.03	.770	.2751			

TABLE IV

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 21- 8 CONF. L5 C1 E8 B3 PWT T1 R1 AD THETA 3/4 =29.0 DEG N = 5997 RPM

M = 2140 PSF PINF = 2136.22 PSF TSC = 68 DEG F RHO = .00235 SLUGS/CU FT

MINF = .0503 VINF = 56.71 FPS QU = 3.729 PSF Q = 3.781 PSF

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	297.56	290.56	273.60	273.49	251.79	251.54	232.74	231.81	223.09	219.74	254.59

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	14.86	14.91	14.94	15.00	15.03	15.04	15.05	15.07	15.08	15.10	15.11	15.13	15.14

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	15.14	15.15	15.16	15.17	15.17	14.84	15.18	15.19	15.19	15.19	15.18	15.13

TABLE IV

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 29- 7 CONF. L4 C1 L7 B3 PW1 T1 R1 RE THETA 3/4 =20.0 DEG N = 5999 RPM

H = 2097 PSF PINF = 2099.62 PSF TSC = 71 DEG F RHO = .00225 SLUGS/CU FT

MINF = .1991 VINF = 224.43 FPS QU = 53.472 PSF Q = 56.616 PSF

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	222.84	224.29	220.32	223.30	218.79	220.37	218.16	219.97	219.58	219.72	220.73

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	14.53	14.59	14.63	14.67	14.68	14.66	14.70	14.72	14.72	14.72	14.72	14.71	14.72

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	14.74	14.73	14.73	14.73	14.72	14.72	14.70	14.47	14.57	14.56	14.56	14.56

TABLE IV

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 30- 8 CONF. L4 C2 C7 A3 FJT T1 R1 RE THETA 3/4 =30.0 DEG N = 6000 RPM

H = 2097 PSF PINF = 2036.65 PSF TSC = 70 DEG F RHO = .00225 SLUGS/CU FT

MINF = .2043 VINF = 230.02 FPS QU = 56.222 PSF Q = 59.528 PSF

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	263.68	266.27	261.69	263.56	255.93	256.06	253.79	253.41	251.85	249.44	257.58

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	14.59	14.64	14.69	14.72	14.74	14.75	14.77	14.79	14.81	14.83	14.84	14.86	14.87

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	14.90	14.91	14.93	14.94	14.95	14.96	14.95	14.62	14.56	14.56	14.56	14.56

TABLE IV

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 32- 5 CONF. L4 C3 E7 B3 PWT T1 R1 RE THETA 3/4 =36.0 DEG N = 6001 RPM

H = 2086 PSF PINF = 1655.70 PSF TSC = 85 DEG F RHO = .00204 SLUGS/CU FT

MINF = .4122 VINF = 464.76 FPS QU = 208.503 PSF Q = 220.763 PSF

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	398.01	403.18	398.47	404.39	398.20	400.42	400.41	403.31	407.09	407.43	402.09

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	14.19	14.33	14.45	14.56	14.62	14.64	14.65	14.66	14.67	14.68	14.70	14.71	14.73

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	14.73	14.73	14.74	14.74	14.74	14.74	14.72	14.09	14.49	14.49	14.48	14.49

TABLE IV

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 33- 2 CONF. L4 C, 67 E3 PUT 11 R1 RE THETA 3/4 =40.0 DEG N = 6004 RPM

H = 2104 PSF PINF = 2047.13 PSF TSC = 74 DEG F RHO = .00224 SLUGS/CU FT

MINF = .1982 VINF = 224.04 FPS QC = 53.183 PSF Q = 56.311 PSF

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	274.33	277.21	270.94	276.16	267.69	270.19	264.65	265.69	265.56	264.71	269.73

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	14.71	14.77	14.81	14.85	14.88	14.90	14.92	14.95	14.98	15.01	15.04	15.05	15.08

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	15.10	15.12	15.13	15.11	15.07	15.04	15.01	14.73	14.61	14.61	14.61	14.61

TABLE IV

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 34- 7 CONF. L4 C1 L7 B3 P&T T1 R1 RE THETA 3/4 =43.0 DEG N = 6000 RPM

H = 2106 PSF PINF = 1879.10 PSF TSC = 73 DEG F RHO = .00212 SLUGS/CU FT

MINF = .4069 VINF = 453.74 FPS QU = 205.648 PSF Q = 217.740 PSF

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	417.74	423.71	416.57	422.48	414.89	415.77	415.63	416.83	419.11	417.52	418.02

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	14.42	14.50	14.61	14.71	14.79	14.83	14.86	14.90	14.92	14.94	14.97	15.00	15.03

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	15.07	15.10	15.12	15.15	15.16	15.17	15.14	14.41	14.62	14.62	14.62	14.63

TABLE IV

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 35- 8 CONF. L4 C3 E7 B3 PVT T1 R1 RE THETA 3/4 =50.0 DEG N = 6000 RPM

H = 2108 PSF PINF = 1878.68 PSF TSC = 83 DEG F RHO = .00208 SLUGS/CU FT

MINF = .4096 VINF = 460.91 FPS QU = 208.268 PSF Q = 220.514 PSF

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	417.29	423.57	418.16	424.51	418.31	421.62	421.68	424.80	427.77	426.66	422.43

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	14.43	14.56	14.67	14.76	14.84	14.90	14.94	14.98	15.01	15.03	15.06	15.09	15.13

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	15.16	15.18	15.20	15.20	15.14	15.08	15.03	14.37	14.64	14.64	14.64	14.64

TABLE IV

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 36- 5 CONF. L4 C1 E7 B3 PWT T1 R1 RE THETA 3/4 =50.0 DEG N = 6002 RPM

H = 2111 PSF PINF = 1681.21 PSF TSC = 86 DEG F RHO = .00207 SLUGS/CU FT

MINF = .4091 VINF = 461.71 FPS QU = 208.170 PSF Q = 220.411 PSF

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	417.74	424.78	418.42	424.98	417.56	421.37	419.97	424.24	427.48	426.52	422.31

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	14.51	14.60	14.69	14.79	14.88	14.93	14.97	15.01	15.04	15.06	15.10	15.12	15.16

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	15.16	15.21	15.23	15.22	15.16	15.10	15.05	14.39	14.66	14.66	14.66	14.66

TABLE IV

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 37- 4 CONF. L4 C1 E7 B3 PWT T1 R1 RE THETA 3/4 =50.0 DEG N = 5499 RPM

H = 2111 PSF PINF = 1619.13 PSF TSC = 95 DEG F RHO = .00183 SLUGS/CU FT

MINF = .6275 VINF = 698.77 FPS QU = 421.430 PSF Q = 446.210 PSF

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	560.20	560.46	566.67	575.33	569.39	570.41	574.51	577.25	583.66	583.72	574.77

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	14.01	14.26	14.51	14.71	14.82	14.85	14.86	14.88	14.89	14.90	14.92	14.93	14.95

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	14.95	14.96	14.96	14.98	14.99	15.00	14.98	13.81	14.66	14.66	14.66	14.66

TABLE IV

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 39- 5 CONF. L4 C1 F7 B3 PIT T2 R1 RE THETA 3/4 =22.0 DEG N = 6001 RPM

H = 2111 PSF PINF = 2053.78 PSF TSC = 68 DEG F RHO = .00228 SLUGS/CU FT

MINF = .1985 VINF = 223.10 FPS QU = 53.512 PSF Q = 56.658 PSF

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	214.67	217.96	205.46	208.62	215.37	218.69	215.39	217.27	212.06	217.69	214.34

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	14.68	14.75	14.76	14.64	14.85	14.86	14.87	14.87	14.87	14.86	14.87	14.87	14.86

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	14.85	14.83	14.81	14.79	14.74	14.69	14.66	14.47	14.66	14.66	14.66	14.66

TABLE IV

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 46- 6 CONF. L4 C: E7 B5 PMT T2 R1 RE THETA 3/4 =30.0 DEG N = 6001 RPM

H = 2108 PSF PINF = 2047.25 PSF TSC = 68 DEG F RHO = .00227 SLUGS/CU FT

MINF = .2048 VINF = 230.12 FPS QU = 56.781 PSF Q = 60.119 PSF

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	256.67	259.34	244.39	248.84	251.80	255.15	249.09	248.59	234.90	248.56	249.73

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	14.69	14.79	14.85	14.89	14.91	14.92	14.92	14.93	14.94	14.96	14.97	14.97	14.97

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	14.97	14.96	14.96	14.95	14.94	14.91	14.89	14.59	14.64	14.64	14.64	14.64

TABLE IV

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 41- 3 CONF. L4 C1 E7 B3 PNT T2 R1 RE THETA 3/4 =32.0 DEG N = 6001 RPM

H = 2106 PSF PINF = 1872.94 PSF TSC = 68 DEG F RHO = .00213 SLUGS/CU FT

MINF = .4128 VINF = 457.96 FPS QC = 210.980 PSF Q = 223.385 PSF

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	364.97	370.42	358.75	363.77	373.68	378.02	373.63	378.24	370.21	384.51	371.62

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	14.25	14.44	14.59	14.69	14.70	14.71	14.71	14.72	14.72	14.66	14.72	14.72	14.73

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	14.71	14.70	14.67	14.64	14.61	14.56	14.54	13.78	14.62	14.62	14.63	14.62

TABLE IV

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 42- 9 CONF. L4 C1 C7 B3 PHT T2 R1 RE THETA 3/4 =40.0 DEG N = 6000 RPM

H = 2105 PSF PINF = 2046.69 PSF TSC = 70 DEG F RHO = .00226 SLUGS/CU FT

MINF = .2004 VINF = 225.59 FPS QU = 54.334 PSF Q = 57.529 PSF

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	276.16	280.37	262.33	267.62	271.26	278.00	269.05	271.30	250.16	269.03	269.55

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	14.71	14.80	14.92	15.01	15.06	15.08	15.10	15.11	15.09	15.11	15.15	15.19	15.22

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	15.21	15.15	15.06	14.97	14.91	14.88	14.85	14.62	14.62	14.62	14.62	14.62

TABLE IV

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 43- 6 CONF. L4 C3 E7 B3 PNT T2 R1 RE THETA 3/4 =43.0 DEG N = 6000 RPM

H = 2104 PSF PINF = 1870.54 PSF TSC = 79 DEG F RHO = .00208 SLUGS/CU FT

MINF = .4134 VINF = 463.35 FPS QU = 211.311 PSF Q = 223.736 PSF

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	413.96	419.01	404.11	409.21	415.43	420.10	413.30	416.22	396.82	419.03	412.72

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	14.40	14.54	14.64	14.75	14.83	14.89	14.93	14.95	14.96	14.97	14.98	14.99	15.01

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	15.01	15.00	15.00	15.00	14.99	14.97	14.92	14.12	14.61	14.61	14.61	14.61

TABLE IV

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 44- 2 CONF. L4 C1 L7 B3 PIT T2 R1 RE THETA 3/4 =43.0 DEG N = 6002 RPM

H = 2101 PSF PINF = 1604.57 PSF TSC = 80 DEG F RHO = .00186 SLUGS/CU FT

MIUF = .6327 VINF = 694.59 FPS QU = 424.646 PSF Q = 449.615 PSF

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	529.59	537.66	526.04	533.62	542.47	547.55	546.16	549.54	534.01	556.98	540.38

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	13.76	14.16	14.46	14.62	14.66	14.67	14.68	14.69	14.69	14.69	14.69	14.68	14.68

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	14.67	14.65	14.64	14.62	14.58	14.53	14.49	12.81	14.57	14.59	14.59	14.59

TABLE IV

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 45- 7 CONF. L4 C1 E7 83 PNT T2 R1 RE THETA 3/4 =49.0 DEG N = 5991 RPM

H = 2099 PSF PINF = 1874.06 PSF TSC = 80 DEG F RHO = .00208 SLUGS/CU FT

MINF = .4086 VINF = 458.66 FPS QU = 206.519 PSF Q = 218.662 PSF

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	430.35	435.44	419.03	425.11	428.35	434.08	426.67	426.98	402.34	429.00	425.74

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	14.47	14.60	14.74	14.81	14.84	14.86	14.91	14.97	15.03	15.07	15.10	15.10	15.12

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	15.14	15.14	15.14	15.13	15.10	15.05	15.01	14.27	14.58	14.57	14.57	14.58

TABLE - IV

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 46- 4 CONF. L4 C1 E7 B3 PIT T2 R1 RE THETA 3/4 =49.0 DEG N = 6001 RPM

H = 2095 PSF PINF = 1597.85 PSF TSC = 86 DEG F RHO = .00184 SLUGS/CU FT

MINF = .6343 VINF = 700.10 FPS QU = 425.045 PSF Q = 450.038 PSF

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	562.78	571.17	559.66	567.69	572.25	577.18	573.79	575.37	558.32	581.78	570.00

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	13.79	14.01	14.34	14.61	14.78	14.80	14.85	14.86	14.87	14.89	14.92	14.93	14.93

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	14.92	14.91	14.90	14.89	14.83	14.79	14.72	13.15	14.55	14.55	14.55	14.55

TABLE IV

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 47- 6 CONF. L4 C1 L7 B3 PNT T2 R1 RE THETA 3/4 =54.0 DEG N = 6006 RPM

H = 2092 PSF PINF = 1597.11 PSF TSC = 87 DEG F RHO = .00183 SLUGS/CU FT

MINF = .6331 VINF = 699.54 FPS QU = 423.271 PSF Q = 448.160 PSF

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	579.66	567.65	574.91	563.01	588.65	593.49	588.41	589.04	570.42	593.71	584.95

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	15.02	14.02	14.27	14.95	14.77	14.88	14.94	14.99	15.01	15.05	15.08	15.09	15.10

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	15.03	15.06	15.08	15.07	15.06	15.03	14.91	13.40	14.53	14.53	14.53	14.53

TABLE IV

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 48- 7 CONF. L4 C1 E7 83 PNT T2 R1 RE THETA 3/4 =30.0 DEG N = 6000 RPM

H = 2091 PSF PINF = 2030.61 PSF TSC = 77 DEG F RHO = .00221 SLUGS/CU FT

MINF = .2050 VINF = 232.31 FPS QU = 56.438 PSF Q = 59.756 PSF

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	257.40	259.89	247.86	250.95	252.82	255.36	248.88	250.04	236.54	248.75	250.85

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	14.57	14.66	14.72	14.75	14.77	14.77	14.78	14.79	14.80	14.82	14.82	14.83	14.83

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	14.84	14.83	14.83	14.82	14.80	14.76	14.74	14.47	14.52	14.52	14.52	14.52

TABLE IV

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 61- 6 CONF. L4 C1 E6 B3 PNT T2 R1 RE THETA 3/4 =22.0 DEG N = 6001 RPM

H = 2120 PSF PINF = 2060.25 PSF TSC = 74 DEG F RHO = .00226 SLUGS/CU FT

MINF = .2025 VINF = 228.83 FPS QU = 55.857 PSF Q = 59.142 PSF

INLET VELOCITIES, FPS

OR,F.	01	03	04	06	07	09	10	12	13	15	AVE
VE,.	185.30	190.43	185.39	188.55	195.18	198.22	198.23	201.07	197.97	203.77	194.41

EXIT TOTAL PRESSURES, PSIA

OR,F.	01	02	03	04	05	06	07	08	09	10	11	12	13
PR,S.	14.79	14.86	14.89	14.91	14.93	14.94	14.94	14.95	14.96	14.96	14.96	14.96	14.95

OR,F.	14	15	16	17	18	19	20	21	22	23	24	25
PR,S.	14.95	14.92	14.90	14.60	14.81	14.77	14.49	14.64	14.72	14.72	14.75	14.72

TABLE IV

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 62- 8 CONF. L4 C1 E6 F3 PNT T2 R1 RE THETA 3/4 =28.0 DEG N = 6000 RPM

H = 2104 PSF PINF = 2043.27 PSF TSC = 67 DEG F RHO = .00227 SLUGS/CU FT

MINF = .2050 VINF = 230.08 FPS QU = 56.757 PSF Q = 60.094 PSF

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	211.31	215.97	204.75	209.56	214.74	218.78	216.78	216.93	208.42	218.96	213.62

EXIT TOTAL PRESSURES PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	14.72	14.81	14.85	14.88	14.88	14.89	14.90	14.91	14.92	14.93	14.94	14.94	14.94

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	14.95	14.94	14.93	14.91	14.87	14.85	14.42	14.52	14.61	14.61	14.61	14.61

TABLE IV

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 63- 3 CONF. L4 C[illegible] E6 F3 PNT T2 R1 RE THETA 3/4 =30.0 DEG N = 6000 RPM

H = 2104 PSF PINF = 1871.33 PSF TSC 72 DEG F RHO = .00211 SLUGS/CU FT

MINF = .4126 VINF = 459.51 FPS QU = 210.627 PSF Q = 223.011 PSF

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	300.62	307.66	300.28	307.67	319.53	325.14	327.66	333.05	331.14	342.60	319.54

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	14.33	14.46	14.60	14.71	14.74	14.74	14.74	14.76	14.76	14.75	14.75	4.75	14.75

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	14.74	14.72	14.70	14.66	14.61	14.59	13.70	13.88	14.40	14.58	14.61	14.61

TABLE IV

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 64- 5 CONF. L4 C1 E6 B3 PNT T2 R1 RE THETA 3/4 =41.0 DEG N = 6000 RPM

H = 2103 PSF PINF = 1869.61 PSF TSC 79 DEG F RHO = .00208 SLUGS/CU FT

MINF = .4134 VINF = 463.39 FPS QU = 211.246 PSF Q = 223.667 PSF

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	332.83	340.98	338.81	338.74	348.79	355.07	354.78	358.03	347.29	366.47	347.38

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	14.5	14.65	14.69	14.76	14.83	14.88	14.93	14.96	14.99	14.99	15.01	15.01	15.02

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	15.03	15.02	15.02	15.01	14.99	14.95	13.72	14.24	14.60	14.63	14.61	14.61

TABLE I-V

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 63- 3 CONF. L4 C1 E6 P3 PNT T2 R1 RE THETA 3/4 =41.0 DEG N = 5998 RPM

H = 2102 PSF PINF = 1596.36 PSF TSC 89 DEG F RHO = .00183 SLUGS/CU FT

MINF = .6395 VINF = 707.32 FPS QU = 431.611 PSF Q = 456.990 PSF

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	11	12	13	15	AVE
VEL.	436.12	448.99	441.59	449.71	463.60	473.59	478.20	481.93	477.29	495.84	464.70

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	13.93	14.21	14.49	14.67	14.72	14.72	14.73	14.74	14.75	14.74	14.77	4.76	14.75

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	14.73	14.72	14.70	14.67	14.62	14.58	12.44	12.78	13.93	14.49	14.59	14.60

TABLE IV

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 56- 8 CONF. L4 C1 E6 G3 PNT T2 R1 RE THETA 3/4 =47.0 DEG N = 6000 RPM

H = 2102 PSF PINF = 1867.96 PSF TSC = 80 DEG F RHO = .00208 SLUGS/CU FT

MINF = .4141 VINF = 464.61 FPS QU = 211.807 PSF Q = 224.261 PSF

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	335.89	344.75	335.46	344.49	353.41	362.16	362.75	367.66	353.03	376.14	353.56

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	14.66	14.72	14.85	14.92	14.91	14.91	14.95	15.01	15.08	15.12	15.17	15.19	15.19

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	15.16	15.08	15.00	14.94	14.90	14.89	13.71	14.24	14.60	14.6.	14.60	14.60

TABLE IV

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 67- 5 CONF. L4 C1 E6 P3 PNT T2 R1 RE THETA 3/4 =47.0 DEG N = 6000 RPM

H = 2102 PSF PINF = 1603.35 PSF TSC = 94 DEG F RHO = .00182 SLUGS/CU FT

MINF = .6342 VINF = 705.09 FPS QU = 426.349 PSF Q = 451.418 PSF

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	455.72	467.40	460.51	468.95	482.64	490.16	493.57	498.24	486.22	509.60	481.30

EXIT TOTAL PRESSURES PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	14.07	14.23	14.46	14.68	14.83	14.88	14.91	14.93	14.95	14.94	14.97	14.98	15.00

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	15.01	15.00	15.00	14.99	14.95	14.88	12.68	13.06	14.27	14.59	14.60	14.60

TABLE IV

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 68- 6 CONF. L4 C1 E6 P3 PNT T2 R1 RE THETA 3/4 =52.0 DEG N = 5999 RPM

H = 2101 PSF PINF = 1606.82 PSF TSC 98 DEG F RHO = .00181 SLUGS/CU FT

MINF = .6310 VINF = 704.30 FPS QU = 422.945 PSF Q = 447.814 PSF

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	467.21	478.96	471.78	481.14	493.36	501.79	503.50	508.06	489.95	517.63	491.34

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	14.20	14.34	14.48	14.63	14.78	14.89	14.99	15.05	15.09	15.1[illegible]	15.14	15.16	15.18

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	15.2[illegible]	15.19	15.18	15.16	15.11	14.85	12.53	13.26	14.46	14.59	14.60	14.59

TABLE IV

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 69- 2 CONF. L4 C1 E6 B3 PNT T2 R1 RE THETA 3/4 =38.0 DEG N = 6105 RPM

H = 2097 PSF PINF = 1601.77 PSF TSC = 88 DEG F RHO = .00183 SLUGS/CU FT

MINF = .6325 VINF = 699.52 FPS QU = 423.646 PSF Q = 448.556 PSF

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	429.31	441.19	436.51	444.49	457.66	467.62	471.99	475.10	471.60	489.35	458.48

EXIT TOTAL PRESSURES PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	13.93	14.22	14.46	14.61	14.65	14.65	14.66	14.66	14.67	14.68	14.69	14.68	14.66

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	14.65	14.63	14.60	14.58	14.52	14.51	12.45	12.70	13.73	14.29	14.53	14.56

TABLE IV

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 70- 9 CONF. L4 C1 E6 ~3 PNT T2 R1 RE THETA 3/4 =38.0 DEG N = 5000 RPM

H = 2097 PSF PINF = 2036.93 PSF TSC = 79 DEG F RHO = .00221 SLUGS/CU FT

MINF = .2042 VINF = 231.79 FPS QU = 56.143 PSF Q = 59.444 PSF

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	228.24	235.13	223.47	232. 3	235.30	242.57	240.95	243.21	226.96	243.90	235.18

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	14.69	14.77	14.89	14.98	15.03	15.04	15.05	15.07	15.07	15.10	15.14	15.18	15.17

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	15.11	15.00	14.90	14.84	14.83	14.83	14.42	14.52	14.56	14.56	14.56	14.56

TABLE IV

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 71- 8 CONF. L4 C1 E6 B3 PNT T2 R1 RE THETA 3/4 =28.0 DEG N = 6001 RPM

H = 2096 PSF PINF = 2034.78 PSF TSC = 74 DEG F RHO = .00223 SLUGS/CU FT

MINF = .2062 VINF = 232.99 FPS QU = 57.209 PSF Q = 60.573 PSF

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	211.50	216.38	207.41	212.09	215.97	218.90	217.45	219.20	209.45	219.53	214.79

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	14.86	14.75	14.80	14.82	14.83	14.84	14.85	14.86	14.87	14.87	14.88	14.88	14.89

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	14.89	14.88	14.88	14.86	14.82	14.80	14.36	14.46	14.55	14.55	14.56	14.56

TABLE V

HS VG SHROUDED PROPELLER TEST

SHROUD INLET VELOCITIES - FT/SEC

RUN 15 M = 0.10 THETA 3/4 = 36.00 DEG CONF L5 C1 E8 B3 PWT T1 R1 AD

PT	RPM	V01	V03	V04	V06	V07	V09	V10	V12	V13	V15	VAVE
2	4002	226.62	220.40	229.84	229.57	214.55	213.6	205.56	203.29	197.62	196.53	213.77
3	5000	284.56	278.67	277.72	276.60	258.23	256.9	246.02	243.09	236.0	231.89	258.97
4	6002	349.58	341.57	333.56	334.03	307.42	307.6	293.08	288.53	279.13	274.93	31 .94
5	7000	427.91	419.61	403.90	405.10	368.63	369.5	349.85	344.71	332.49	325.84	374.75
6	7000	427.71	419.63	403.12	404.24	369.87	369.9	349.80	345.12	332.57	326.11	374.71

RUN 16 M = 0.02 THETA 3/4 = 36.00 DEG CONF L5 C1 E8 B3 PWT R1 AD

PT	RPM	V01	V03	V04	V06	V07	V09	V10	V12	V13	V15	VAVE
2	4001	222.02	215.85	200.70	199.48	183.40	182.8	172.48	168.52	161.28	158.2	186.48
3	5004	282.89	275.65	255.90	254.81	233.14	232.7	218.73	213.57	204.97	2 .24	237.26
4	6002	349.94	340.69	317.61	317.32	286.07	286.4	268.44	262.19	251.46	245.57	292.66
5	7002	428.94	419.17	391.68	391.76	351.34	350.9	328.49	322.96	308.2	299.91	359.34

RUN 17 M = 0.02 THETA 3/4 = 22.00 DEG CONF L5 C1 E8 B3 PWT T1 R1 AD

PT	RPM	V01	V03	V04	V06	V07	V09	V10	V12	V13	V15	VAVE
2	4000	157.56	152.29	141.81	142.02	131.65	130.2	111.93	122.05	117.49	116.46	132.35
3	5000	198.80	194.00	178.02	177.83	167.05	165.0	154.15	153.03	147.5	143.53	168. 9
4	6000	243.00	235.96	219.53	220.37	201.03	201.6	187.77	185.80	178.39	175.8	2 4.93
5	7001	291.42	283.03	263.76	264.00	3 C						

TABLE V

HS VG SHROUDED PROPELLER TEST

SHROUD INLET VELOCITIES - FT/SEC

RUN 18 M = 0.05 THETA 3/4 = 22.00 DEG CONF L5 C1 E8 B3 PWT T1 R1 AD

PT	RPM	V01	V03	V04	V06	V07	V09	V10	V12	V13	V15	VAVE
2	4001	153.36	148.96	147.24	146.42	139.05	139.0	132.11	132.34	127.42	125.26	139.12
3	5000	196.05	191.17	182.79	182.95	170.69	169.9	161.90	161.33	155.39	153.22	172.55
4	5993	242.50	236.47	223.97	222.87	207.92	206.8	195.76	195.44	187.5	183.38	21 .27
5	7003	286.89	279.44	263.98	264.92	242.44	243.4	228.65	226.35	218.7	215.15	247.

RUN 19 M = 0.05 THETA 3/4 = 29.00 DEG CONF L5 C1 E8 B3 PWT T1 R1 AD

PT	RPM	V01	V03	V04	V06	V07	V09	V10	V12	V13	V15	VAVE
2	3002	141.39	137.50	134.10	133.87	126.52	127.2	96.70	119.89	116.03	114.72	124.8
3	3500	165.24	160.42	156.72	155.17	145.82	144.9	137.92	136.60	131.64	128.14	146.27
4	4001	190.77	185.31	177.40	176.21	164.10	164.8	153.39	155.15	149.17	146. 8	166.24
5	4500	217.18	210.49	199.13	199.83	185.01	184.8	175.37	170.80	166.99	165.16	187.38
6	5001	241.70	235.82	222.96	222.00	206.04	205.1	192.06	191.25	184.78	182.29	208.41
7	5502	267.91	262.11	246.54	246.02	226.83	227.1	213.16	210.99	203.58	199.63	23 .4
8	6000	296.08	289.11	270.93	270.47	248.76	248.3	234.75	229.58	222.36	218.75	252.92
9	7000	355.23	347.67	326.18	325.90	296.87	296.2	278.95	275.16	264.28	259. 9	3 2.55

RUN 20 M = 0.10 THETA 3/4 = 29.00 DEG CONF L5 C1 E8 B3 PWT T1 R1 AD

PT	RPM	V01	V03	V04	V06	V07	V09	V10	V12	V13	V15	VAVE
2	4001	199.45	193.19	201.25	202.61	190.18	190.6	182.42	181.07	178.33	178.31	189.26
3	4999	243.09	239.39	240.07	240.73	224.19	223.9	214.62	213.33	207.79	2 6.14	225.37
4	6001	294.67	288.02	283.95	283.09	263.54	263.7	251.05	248.82	241.38	237.77	265.69
5	7001	354.28	347.96	335.64	336.11	309.09	311.0	295.65	292.12	282.71	277.79	314.32

TABLE V

HS VG SHROUDED PROPELLER TEST

SHROUD INLET VELOCITIES - FT/SEC

RUN 49 M = 0.20 THETA 3/4 = 30.00 DEG CONF L4 C1 E7 B3 PNT T2 R1 AD

PT	RPM	V01	V03	V04	V06	V07	V09	V10	V12	V13	V15	VAVE
2	4000	204.24	206.23	196.11	198.34	205.11	206.9	204.96	207.73	199.4	2 6.44	2 3.55
3	5002	225.01	225.99	216.76	220.37	223.49	226.4	220.24	222.83	213.05	224.4	221.86
4	6000	255.04	256.78	242.87	246.76	249.99	254.0	247.73	246.69	232.96	246.71	247.96
5	7003	294.18	297.97	279.06	282.25	283.90	288.0	278.67	278.21	256.73	273.34	281.24
6	6000	253.39	256.14	241.77	244.13	247.75	251.7	245.80	245.27	230.39	243.88	246. 3

A-3

RUN 50 M = 0.60 THETA 3/4 = 49.00 DEG CONF L4 C1 E7 B3 PNT T2 R1 AD

PT	RPM	V01	V03	V04	V06	V07	V09	V10	V12	V13	V15	VAVE
2	5005	537.26	545.06	535.00	541.56	550.53	554.5	553.67	557.25	545.15	563.74	548.38

RUN 51 M = 0.40 THETA 3/4 = 49.00 DEG CONF L4 C1 E7 B3 PNT T2 R1 AD

PT	RPM	V01	V03	V04	V06	V07	V09	V10	V12	V13	V15	VAVE
2	3501	365.75	371.08	361.31	363.48	370.77	376.8	374.40	377.04	370.57	382.77	371.4
3	4001	376.81	382.53	371.85	373.97	380.56	386.7	383.35	385.68	375.75	39 .72	38 .8
5	6002	366.67	372.11	355.45	362.21	360.31	367.7	358.61	360.45	403.65	362.98	367. 9
6	6000	362.00	368.60	352.46	361.63	363.53	374.1	358.94	370.36	412.3	372.85	369.68

TABLE V

HS VG SHROUDED PROPELLER TEST

SHROUD INLET VELOCITIES - FT/SEC

RUN 52 M = 0.60 THETA 3/4 = 43.00 DEG CONF L4 C1 E7 B3 PNT T2 P1 AD

PT	RPM	V01	V03	V04	V06	V07	V09	V10	V12	V13	V15	VAVE
4	6053	535.25	544.15	532.26	539.37	547.88	552.3	551.16	554.93	545.07	562.	546.45
5	6503	543.75	551.60	545.23	547.69	551.11	561.4	559.12	562.33	551.65	569.81	554.37
6	7003	548.28	561.12	550.57	558.02	565.94	571.1	563.55	571.31	559.86	524.6	557.44
7	7506	570.67	574.79	567.26	520.27	573.19	525.5	569.92	526.35	565.95	531.72	552.57
		578.29	527.46	517.82	584.35	528.49	531.2	530.75	529.38	574.19	589.11	549.11

V-4

RUN 53 M = 0.40 THETA 3/4 = 43.00 DEG. CONF L4 C1 E7 B3 PNT T2 R1 AD

PT	RPM	V01	V03	V04	V06	V07	V09	V10	V12	V13	V15	VAVE
2	4052	368.80	374.84	367.22	370.92	377.45	374.1	379.48	382.64	376.07	388.3	375.99
3	5002	391.47	397.21	386.54	382.16	396.49	403.1	398.83	401.36	389.82	4 6.43	395.35
4	6002	418.93	422.47	410.73	415.76	420.11	419.1	419.95	420.28	403.54	418.63	416.95
5	7002	454.91	460.82	445.19	451.93	452.70	460.3	452.17	451.63	418.6	452.48	45 . 7

RUN 72 M = 0.20 THETA 3/4 = 28.00 DEG CONF L4 C1 E6 B3 PNT T2 R1 AD

PT	RPM	V01	V03	V04	V06	V07	V09	V10	V12	V13	V15	VAVE
2	4000	183.22	176.74	182.42	181.04	179.49	175.2	169.06	165.70	170.25	166.92	175. 1
3	5001	199.23	190.15	197.08	197.40	196.92	191.8	189.42	185.07	190.31	187.82	192.53
4	5999	219.75	208.66	219.10	218.67	220.56	215.4	212.28	208.40	216.68	211.99	215.16
5	7000	244.61	229.25	244.60	245.51	250.63	244.0	244.29	238.52	249.75	244.76	243.6

TABLE V

HS VG SHROUDED PROPELLER TEST

SHROUD INLET VELOCITIES - FT/SEC

RUN 73 M = 0.40 THETA 3/4 = 41.00 DEG CONF L4 C1 E6 B3 PNT T2 R1 AD

PT	RPM	V01	V03	V04	V06	V07	V09	V10	V12	V13	V15	VAVE
2	4001	335.87	325.59	327.57	323.16	320.84	315.7	307.23	301.62	302.96	296.75	315.73
3	5001	349.38	333.81	340.53	336.21	336.26	328.5	321.39	315.52	317.94	311.71	329.13
4	6000	365.47	345.42	359.53	356.37	357.47	349.4	345.11	337.18	341.85	335.35	349.32
5	7001	389.30	363.47	385.33	383.32	385.23	375.4	372.64	362.90	371.05	361.94	375. 7

RUN 74 M = 0.60 THETA 3/4 = 41.00 DEG CONF L4 C1 E6 B3 PNT T2 R1 AD

PT	RPM	V01	V03	V04	V06	V07	V09	V10	V12	V13	V15	VAVE
2	5558	481.78	467.21	472.75	467.95	463.75	455.1	443.13	436.21	437.94	425.98	455.19
3	6004	489.76	472.88	480.23	476.37	473.41	463.1	453.32	445.09	448.16	436.72	463.95
4	7003	502.70	481.91	494.88	489.46	487.43	479.1	469.51	460.00	464.49	453.26	478.28

RUN 75 M = 0.40 THETA 3/4 = 47.00 DEG CONF L4 C1 E6 B3 PNT T2 R1 AD

PT	RPM	V01	V03	V04	V06	V07	V09	V10	V12	V13	V15	VAVE
2	4000	344.41	331.58	337.65	333.79	332.21	324.8	315.60	311.00	314.84	3 7.81	325.37
3	5002	359.70	341.06	352.49	348.29	349.11	341.3	333.91	326.80	331.54	324.91	34 .92
4	6001	374.99	352.97	367.34	363.47	363.93	353.9	348.31	339.29	344.59	336.88	354.57
5	6951	391.92	366.84	385.37	379.26	380.05	367.6	362.68	350.58	358.25	348.91	369.15

TABLE V

HS VG SHROUDED PROPELLER TEST

SHROUD INLET VELOCITIES - FT/SEC

RUN 76 M = 0.60 THETA 3/4 = 47.00 DEG CONF L4 C1 E6 B3 PNT T2 R1 AD

PT	RPM	V01	V03	V04	V06	V07	V09	V10	V12	V13	V15	VAVE
2	4504	482.95	471.12	473.39	469.09	465.12	455.0	444.54	437.37	440.67	428.65	456.8
3	5000	494.26	477.61	484.26	479.35	475.53	467.2	457.91	450.21	452.67	44 .72	467.98
4	6003	505.16	484.76	497.25	492.23	489.80	481.3	471.05	462.16	467.75	456.98	48 .85
5	6802	518.94	494.48	513.35	508.16	507.81	497.9	489.56	478.94	485.77	474.15	496.91
6	6002	505.24	485.05	496.77	491.61	488.88	481.1	471.84	462.59	467.73	457.36	48 .82
7	5001	493.85	478.69	484.93	478.96	475.34	467.2	455.81	449.01	452.19	44 .2	467.63

TABLE VI

HS VG SHROUDED PROPELLER TEST

TRAVERSING PROBE DATA

RUN 22 CONF. L5 C1 E8 B3 PWT T1 R1 RE TP THETA 3/4 = 29.0 DEG

H = 2133 PSF P1NF = 2132 PSF TSC = 74 DEG RHO = 0.00232 SLUGS/CU FT

M = 0.0230 V1NF = 23.12 FPS Q = 0.62 PSF N = 7000 RPM

PT NO	DISTANCE D IN		ZETA DEG	THETA DEG	TTP DEG F	PT PSIA	PS PSIA	VTP FPS	VPR FPS
2	17.00		6.10	-42.79	71	15.16	14.46	291.66	212.83
3	15.00		2.60	-39.30	71	15.30	14.33	343.62	265.62
4	10.00		8.20	-26.30	70	15.19	14.46	299.34	265.62
5	10.00	(6500 RPM)	8.40	-18.96	70	15.14	14.50	277.95	260.05
6	10.00	(7500 RPM)	8.40	-25.24	70	15.24	14.40	320.42	286.71
7	6.00		11.30	10.63	70	15.03	14.54	245.97	237.06

RUN 23 CONF. L5 C1 E8 B3 PWT T1 R1 RE TP THETA 3/4 = 29.0 DEG

H = 2131 PSF P1NF = 2127 PSF TSC = 74 DEG RHO = 0.00231 SLUGS/CU FT

M = 0.0503 V1NF = 56.88 FPS Q = 3.74 PSF N = 7000 RPM

PT NO	DISTANCE D IN		ZETA DEG	THETA DEG	TTP DEG F	PT PSIA	PS PSIA	VTP FPS	VPR FPS
2	4.32		12.00	28.69	69	14.88	14.64	172.60	148.11
3	6.00		10.80	-16.48	69	15.01	14.50	249.51	235.02
4	10.00		8.00	-32.10	70	15.16	14.43	298.13	250.11
5	10.00	(6500 RPM)	7.80	-26.61	70	15.11	14.48	277.42	245.74
6	10.00	(7500 RPM)	8.10	-28.57	71	15.22	14.38	319.86	278.11
7	15.00		1.80	-31.47	72	15.28	14.35	336.72	287.07
8	17.00		5.20	-17.18	72	15.11	14.50	274.59	261.25

TABLE VI

HS VG SHROUDED PROPELLER TEST

TRAVERSING PROBE DATA

RUN 24 CONF. L5 C1 E8 B3 PWT T1 R1 RE TP THETA 3/4 = 29.0 DEG

H = 2132 PSF PINF = 2116 PSF TSC = 76 DEG RHO = 0.00230 SLUGS/CU FT

M = 0.1022 VINF = 117.08 FPS Q = 15.75 PSF N = 7003 RPM

PT NO	DISTANCE D IN		ZETA DEG	THETA DEG	TTP DEG F	PT PSIA	PS PSIA	VTP FPS	VPR FPS
2	17.00		2.80	-40.28	71	15.06	14.46	273.00	208.02
3	15.00		.40	-38.95	72	15.24	14.28	342.98	266.73
4	10.00		6.20	-32.12	72	15.14	14.40	301.82	254.11
5	10.00	(6500 RPM)	5.70	-27.39	71	15.09	14.44	280.63	247.95
6	10.00	(7500 RPM)	7.00	-30.24	72	15.20	14.34	324.56	278.30
7	6.00		8.90	-2.64	71	15.00	14.46	257.32	253.96
8	4.29		8.40	32.11	71	14.86	14.59	182.71	153.10

RUN 55 CONF. L4 C1 E7 B3 PNT T2 R1 RE TP THETA 3/4 = 43.0 DEG

H = 2109 PSF PINF = 1876 PSF TSC = 84 DEG RHO = 0.00207 SLUGS/CU FT

M = 0.4133 VINF = 465.37 FPS Q = 224.16 PSF N = 7000 RPM

PT NO	DISTANCE D IN		ZETA DEG	THETA DEG	TTP DEG F	PT PSIA	PS PSIA	VTP FPS	VPR FPS
2	14.75		72.50	-10.04	84	15.11	13.22	495.09	146.60
3	12.00		78.00	.28	84	15.43	12.83	579.25	120.43
4	12.00	(4300 RPM)	.60	-.22	77	14.70	13.41	408.66	408.64
5	12.00	(5500 RPM)	3.50	-.16	80	14.93	13.26	464.47	463.61
6	9.00		8.70	.65	84	15.31	12.91	557.39	550.94
7	6.00		11.50	2.85	84	15.15	13.11	515.18	504.22
8	4.69		12.20	6.08	80	14.78	13.44	417.48	405.76
9	12.00		7.70	.31	86	15.42	12.83	580.64	575.39
10	14.70		7.20	-9.60	86	15.09	13.23	491.92	481.21

TABLE VI

HS VG SHROUDED PROPELLER TEST

TRAVERSING PROBE DATA

RUN 56 CONF. L4 C1 E7 B3 PNT T2 R1 RE TP THETA 3/4 = 43.0 DEG

H = 2111 PSF P1NF = 1614 PSF TSC = 96 DEG RHO = 0.00182 SLUGS/CU FT

M = 0.6311 V1NF = 703.16 FPS Q = 450.06 PSF N = 7000 RPM

PT NO	DISTANCE D IN		ZETA DEG	THETA DEG	TTP DEG F	PT PSIA	PS PSIA	VTP FPS	VPR FPS
2	14.75		.90	-10.49	90	14.61	12.35	557.17	547.79
3	12.00		1.40	-.06	94	14.84	12.07	617.72	617.54
4	12.00	(6300 RPM)	.60	.17	93	14.71	12.17	593.20	593.16
5	9.00		3.10	.22	96	14.94	11.97	640.86	639.92
6	6.00		5.60	1.34	95	14.91	12.15	616.53	613.42
7	4.69		7.00	3.38	94	14.77	12.31	580.85	575.52

RUN 57 CONF. L4 C1 E7 B3 PNT T2 R1 RE TP THETA 3/4 = 32.0 DEG

H = 2111 PSF P1NF = 1877 PSF TSC = 88 DEG RHO = 0.00206 SLUGS/CU FT

M = 0.4134 V1NF = 467.19 FPS Q = 224.47 PSF N = 7000 RPM

PT NO	DISTANCE D IN		ZETA DEG	THETA DEG	TTP DEG F	PT PSIA	PS PSIA	VTP FPS	VPR FPS
2	4.69		7.00	2.86	84	14.77	13.49	409.40	405.84
3	6.00		5.50	.36	84	14.82	13.44	425.34	423.38
4	9.00		3.30	-.69	84	14.90	13.29	459.48	458.68
5	12.00		2.00	-.46	84	14.86	13.30	451.38	451.09
6	12.00	(6000 RPM)	-.20	-.76	82	14.65	13.46	394.66	394.63
7	12.00	(8000 RPM)	3.50	-.61	87	15.01	13.18	490.65	489.71
8	14.75		.10	-9.53	82	14.58	13.64	351.47	346.62

TABLE VI

HS V6 SHROUDED PROPELLER TEST

TRAVERSING PROBE DATA

RUN 58 CONF. L4 C1 E7 B3 PNT T2 R1 RE TP THETA 3/4 = 30.0 DEG

H = 2111 PSF P1NF = 2049 PSF TSC = 81 DEG RHO = 0.00222 SLUGS/CU FT

M = 0.2064 V1NF = 234.73 FPS Q = 61.12 PSF N = 7000 RPM

PT NO	DISTANCE D IN		ZETA DEG	THETA DEG	TTP DEG F	PT PSIA	PS PSIA	VTP FPS	VPR FPS
2	14.75		7.40	-9.20	79	14.96	14.14	321.64	314.85
3	12.00		7.90	.83	80	15.15	13.92	394.99	391.20
4	12.00	(6000 RPM)	6.40	.73	77	14.97	14.08	334.94	332.83
5	12.00	(8000 RPM)	9.90	-.31	83	15.45	13.66	475.44	468.35
6	9.00		10.90	-.10	80	15.14	13.92	392.68	385.60
7	6.00		14.70	1.44	79	15.07	14.01	366.12	354.02
8	4.69		18.30	7.24	78	14.91	14.16	307.81	289.91

RUN 59 CONF. L4 C1 E7 B3 PNT T2 R1 RE TP THETA 3/4 = 30.0 DEG

H = 2112 PSF P1NF = 2051 PSF TSC = 80 DEG RHO = 0.00222 SLUGS/CU FT

M = 0.2057 V1NF = 233.74 FPS Q = 60.75 PSF N = 7000 RPM

PT NO	DISTANCE D IN		ZETA DEG	THETA DEG	TTP DEG F	PT PSIA	PS PSIA	VTP FPS	VPR FPS
2	4.69		18.40	7.50	76	14.91	14.16	306.98	288.80
3	6.00		14.70	1.76	78	15.08	14.01	366.98	354.80
4	9.00		10.80	.21	78	15.15	13.93	392.28	385.33
5	12.00		8.10	.49	78	15.16	13.93	394.36	390.41
6	12.00	(6000 RPM)	6.30	1.16	76	14.97	14.08	333.55	331.46
7	12.00	(8000 RPM)	9.70	-.34	82	15.46	13.66	475.49	468.69
8	14.75		7.80	-8.84	78	14.97	14.15	321.69	314.93

TABLE VI

HS VG SHROUDED PROPELLER TEST

TRAVERSING PROBE DATA

RUN 77 CONF. L4 C1 E6 B3 PNT T2 R1 RE TP THETA 3/4 = 28.0 DEG

H = 2092 PSF P1NF = 2031 PSF TSC = 70 DEG RHO = 0.00224 SLUGS/CU FT

M = 0.2062 V1NF = 232.05 FPS Q = 60.42 PSF N = 6500 RPM

PT NO	DISTANCE D IN		ZETA DEG	THETA DEG	TTP DEG F	PT PSIA	PS PSIA	VTP FPS	VPR FPS
2	14.26		5.50	-12.97	66	14.77	14.09	290.78	282.05
3	12.00		7.90	3.47	67	14.94	13.93	355.26	351.24
4	10.00		10.00	2.68	67	14.96	13.89	364.67	358.73
5	10.00	(5500 RPM)	8.30	3.33	65	14.80	14.03	309.41	305.65
6	10.00	(7500 RPM)	11.30	2.88	69	15.19	13.69	430.83	421.95
7	6.69		14.20	1.98	67	14.91	13.95	345.90	335.13
8	4.69		19.60	6.59	65	14.77	14.08	293.50	274.66

RUN 79 CONF. L4 C1 E6 B3 PNT T2 R1 RE TP THETA 3/4 = 30.0 DEG

H = 2092 PSF P1NF = 1859 PSF TSC = 76 DEG RHO = 0.00208 SLUGS/CU FT

M = 0.4139 V1NF = 462.59 FPS Q = 222.93 PSF N = 6500 RPM

PT NO	DISTANCE D IN		ZETA DEG	THETA DEG	TTP DEG F	PT PSIA	PS PSIA	VTP FPS	VPR FPS
2	4.69		8.00	2.04	76	14.65	13.49	388.09	384.07
3	6.69		5.30	.97	78	14.68	13.42	404.43	402.64
4	10.00		2.80	2.37	79	14.74	13.29	434.52	433.63
5	10.00	(5500 RPM)	.30	2.13	78	14.53	13.43	378.35	378.08
6	10.00	(7500 RPM)	5.10	2.83	76	14.97	13.11	490.25	487.72
7	12.00		1.70	2.87	74	14.70	13.35	416.85	416.14
8	14.26		1.80	-17.56	73	14.42	13.65	314.29	299.49

TABLE VI

HS VG SHROUDED PROPELLER TEST

TRAVERSING PROBE DATA

RUN 80 CONF. L4 C1 E6 B3 PNT T2 R1 RE TP THETA 3/4 = 41.0 DEG

H = 2090 PSF P1NF = 1592 PSF TSC = 94 DEG RHO = 0.00180 SLUGS/CU FT

M = 0.6356 V1NF = 706.50 FPS Q = 450.27 PSF N = 6500 RPM

PT NO	DISTANCE O IN		ZETA DEG	THETA DEG	TTP DEG F	PT PSIA	PS PSIA	VTP FPS	VPR FPS
2	14.26		5.30	-23.66	86	14.37	12.57	496.25	452.61
3	12.00		2.10	1.74	90	14.79	12.13	603.85	603.17
4	10.00		3.00	1.69	90	14.77	12.10	604.75	603.66
5	10.00	(5500 RPM)	.80	1.67	90	14.38	12.39	525.32	525.05
6	10.00	(7500 RPM)	4.90	2.50	89	15.09	11.92	656.00	652.98
7	6.69		5.70	1.48	91	14.74	12.27	581.01	577.95
8	4.69		7.70	2.49	93	14.64	12.45	547.78	542.33

TABLE VII

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 22- 4 CONF. L5 C1 E8 B3 PWT T1 R1 RE TP THETA 3/4 =29.0 DEG N = 7000 RPM

H = 2133 PSF PINF = 2131.84 PSF TSC = 74 DEG F RHO = .00232 SLUGS/CU FT

MINF = .0279 VINF = 31.63 FPS QU = 1.144 PSF Q = 1.160 PSF

SHROUD SURFACE PRESSURE COEFFICIENTS

	LEO	01	02	04	06	08	10	125	15	175	20	25
S1B	-96.079	-159.17	-157.11	-184.39	-204.73	-196.81	-189.03	-160.19	-139.02	-127.52	-114.68	-114.45
S2T		-70.394	.907	-19.947	-5.778	.661	.754	.877	.815	.538	-6.147	

	30	35	40	50	60	70	80	90	92	94	96	98	TEO
S1B	-105.51	-80.749	-73.106	-38.026	-27.493	-18.264	-4.002	-4.825	-2.563	-2.873	-2.378	-1.448	.194
S2T	.908		1.093	.567	.846	.444	.660	.475					

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	362.39	353.71	326.20	325.62	296.28	295.53	274.56	270.72	259.37	253.83	301.82

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	14.81	14.87	14.91	14.99	15.04	15.06	15.08	15.10	15.12	15.14	15.16	15.19	15.21

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	15.22	15.23	15.25	15.26	15.28	15.28	15.30	15.31	15.31	15.31	15.28	15.21

TABLE VII

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 22- 5 CONF. L5 C1 E8 B3 PWT T1 R1 RE TP THETA 3/4 =29.0 DEG N = 6500 RPM

H = 2133 PSF PINF = 2132.34 PSF TSC = 74 DEG F RHO = .00232 SLUGS/CU FT

MINF = .0210 VINF = 23.77 FPS QU = .646 PSF Q = .655 PSF

SHROUD SURFACE PRESSURE COEFFICIENTS

	LEO	01	02	04	06	08	10	125	15	175	20	25
S1B	-138.00	-231.60	-231.16	-270.93	-302.29	-289.54	-279.16	-238.94	-206.03	-190.07	-171.10	-171.76
S2T		-98.510	1.330	-26.434	-7.073	.236	.509	.182	.345	.291	-11.327	

	30	35	40	50	60	70	80	90	92	94	96	98	TEO
S1B	-109.82	-122.85	-109.83	-68.235	-44.204	-28.256	-8.184	-7.412	-4.828	-4.938	-3.893	-2.354	-.045
S2T	.782		.670	1.165	.341	.835	.451	.560					

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	329.24	321.62	299.13	298.81	270.73	270.27	250.64	247.34	236.92	231.96	275.67

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	14.82	14.87	14.90	14.98	15.01	15.03	15.04	15.06	15.07	15.10	15.12	15.14	15.15

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	15.15	15.16	15.17	15.19	15.19	15.20	15.21	15.22	15.22	15.22	15.20	15.14

TABLE VII

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 22- 6 CONF. L5 C1 E8 B3 PWT T1 R1 RE TP THETA 3/4 =29.0 DEG N = 7500 RPM

H = 2133 PSF PINF = 2131.77 PSF TSC = 74 DEG F RHO = .00232 SLUGS/CU FT

MINF = .0288 VINF = 32.63 FPS QU = 1.218 PSF Q = 1.234 PSF

SHROUD SURFACE PRESSURE COEFFICIENTS

	LEO	01	02	04	06	08	10	125	15	175	20	25
S1B	-105.87	-175.47	-173.30	-204.29	-226.76	-218.44	-210.02	-178.38	-153.17	-142.10	-126.69	-126.42
S2T		-77.205	.825	-21.881	-6.304	.565	.797	.826	.710	.507	-5.463	

	30	35	40	50	60	70	80	90	92	94	96	98	TEO
S1E	-113.62	-92.132	-79.884	-42.526	-31.885	-20.281	-5.986	-5.442	-2.439	-3.226	-2.673	-1.682	.126
S2T	.884		1.146	.738	.913	.593	.680	.535					

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	395.39	385.59	357.22	357.04	323.11	322.81	299.76	296.34	283.60	276.56	329.74

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	14.81	14.86	14.91	15.01	15.06	15.09	15.11	15.13	15.16	15.18	15.21	15.24	15.28

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	15.29	15.30	15.33	15.35	15.37	15.38	15.40	15.41	15.42	15.41	15.37	15.27

TABLE VII

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 23- 4 CONF. L5 C1 E8 B3 PWT T1 R1 RE THETA 3/4 =29.0 DEG N = 7002 RPM

H = 2131 PSF PINF = 2127.44 PSF TSC = 74 DEG F RHO = .00231 SLUGS/CU FT

MINF = .0489 VINF = 55.43 FPS QU = 3.508 PSF Q = 3.556 PSF

SHROUD SURFACE PRESSURE COEFFICIENTS

	LEO	01	02	04	06	08	10	125	15	175	20	25
S18	-19.215	-40.973	-43.012	-53.825	-62.031	-60.783	-59.099	-51.502	-44.097	-40.815	-37.174	-37.114
S2T		-8.890	.950	.425	.940	.850	.790	.780	.890	.880	-1.379	

	30	35	40	50	60	70	80	90	92	94	96	98	TEO
S18	-34.284	-26.586	-24.375	-13.016	-9.598	-6.119	-1.799	-1.677	-.878	-.990	-.798	-.394	.091
S2T	.609		.738	.597	.476	.294	.274	.062					

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	358.71	351.03	328.45	326.80	298.56	298.35	278.42	276.36	266.08	259.09	304.19

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	14.79	14.84	14.88	14.97	14.99	15.01	15.04	15.07	15.09	15.11	15.12	15.14	15.16

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	15.19	15.21	15.22	15.23	15.24	15.25	15.27	15.28	15.28	15.28	15.27	15.20

TABLE VII

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 23- 5 CONF. L5 C1 E8 B3 PWT T1 R1 RE THETA 3/4 =29.0 DEG N = 6500 RPM

H = 2131 PSF PINF = 2127.22 PSF TSC = 74 DEG F RHO = .00231 SLUGS/CU FT

MINF = .0504 VINF = 57.12 FPS QU = 3.724 PSF Q = 3.775 PSF

SHROUD SURFACE PRESSURE COEFFICIENTS

	LEO	01	02	04	06	08	10	125	15	175	20	25
S1B	-13.816	-31.379	-33.246	-41.908	-48.847	-47.526	-46.550	-40.807	-35.007	-32.093	-29.444	-29.434
S2T		-5.652	.934	.725	.736	.717	.755	.868	.887	.802	-1.233	

	30	35	40	50	60	70	80	90	92	94	96	98	TEO
S1B	-27.443	-21.459	-19.419	-12.292	-7.756	-4.850	-1.725	-1.388	-.760	-.817	-.579	-.303	.087
S2T	.584		.630	.582	.354	.316	.135	.135					

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	325.22	319.32	299.02	297.65	273.31	272.62	254.77	253.65	244.41	238.02	277.80

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	14.78	14.83	14.87	14.95	14.97	14.99	15.01	15.04	15.06	15.07	15.08	15.09	15.11

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	15.13	15.14	15.15	15.16	15.17	15.18	15.18	15.19	15.19	15.19	15.18	15.12

TABLE VII

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 23- 6 CONF. L5 C1 E8 B3 PWT T1 R1 RE THETA 3/4 =29.0 DEG N = 7500 RPM

H = 2131 PSF PINF = 2127.08 PSF TSC = 74 DEG F RHO = .00231 SLUGS/CU FT

MINF = .0513 VINF = 58.20 FPS QU = 3.866 PSF Q = 3.920 PSF

SHROUD SURFACE PRESSURE COEFFICIENTS

	LEO	01	02	04	06	08	10	125	15	175	20	25
S1B	-21.778	-45.017	-46.685	-58.323	-66.810	-65.400	-63.631	-55.006	-47.238	-43.685	-39.197	-39.445
S2T		-10.861	.927	-.044	1.010	.873	.827	.827	.891	.937	-1.169	

	30	35	40	50	60	70	80	90	92	94	96	98	TEO
S1B	-35.592	-29.145	-25.596	-14.698	-10.173	-6.449	-1.915	-1.694	-.851	-.988	-.796	-.393	.157
S2T	.709		.817	.588	.579	.350	.387	.195					

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	391.54	382.76	357.68	357.14	324.83	325.22	303.00	301.21	289.30	282.06	331.47

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	14.78	14.83	14.89	14.98	15.02	15.04	15.07	15.10	15.13	15.15	15.17	15.19	15.22

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	15.26	15.28	15.30	15.32	15.33	15.34	15.37	15.38	15.39	15.39	15.37	15.30

TABLE VII

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 24- 4 CONF. L5 C1 E8 B3 PWT T1 R1 RE THETA 3/4 =29.0 DEG N = 7003 RPM

H = 2132 PSF PINF = 2116.28 PSF TSC = 76 DEG F RHO = .00230 SLUGS/CU FT

MINF = .1029 VINF = 116.81 FPS QU = 15.463 PSF Q = 15.676 PSF

SHROUD SURFACE PRESSURE COEFFICIENTS

	LEO	01	02	04	06	08	10	125	15	175	20	25	
S1B	-.854	-5.758	-6.970	-10.194	-12.332	-12.783	-12.811	-11.247	-9.665	-8.981	-8.071	-8.256	
S2T		.913	.998	.294	.308	.271	.248	.239	.251	.244	.358		
	30	35	40	50	60	70	80	90	92	94	96	98	TEO
S1B	-7.669	-6.377	-5.977	-3.060	-2.303	-1.428	-.346	-.289	-.096	-.129	-.053	.030	.193
S2T	.403		.508	.419	.284	.183	.137	.112					

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	358.24	351.88	336.99	336.89	309.97	311.21	293.39	291.98	283.01	277.92	315.15

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	14.75	14.83	14.90	14.96	14.99	15.00	15.02	15.04	15.06	15.08	15.10	15.12	15.13
ORIF.	14	15	16	17	18	19	20	21	22	23	24	25	
PRES.	15.16	15.17	15.19	15.20	15.20	15.21	15.22	15.23	15.23	15.23	15.22	15.16	

TABLE VII

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 24- 5 CONF. L5 C1 E8 B3 PWT T1 R1 RE THETA 3/4 =29.0 DEG N = 6500 RPM

H = 2132 PSF PINF = 2116.56 PSF TSC = 76 DEG F RHO = .0023$_0$ SLUGS/CU FT

MINF = .1019 VINF = 115.77 FPS QU = 15.189 PSF Q = 15.398 PSF

SHROUD SURFACE PRESSURE COEFFICIENTS

	LEO	01	02	04	06	08	10	125	15	175	20	25	
S1B	-.372	-4.560	-5.637	-8.531	-10.986	-10.897	-10.928	-9.729	-8.331	-7.675	-6.999	-7.065	
S2T		.968	.989	.139	.194	.159	.157	.136	.139	.115	.303		
	30	35	40	50	60	70	80	90	92	94	96	98	TEO
S1B	-6.628	-5.604	-5.237	-3.142	-2.029	-1.281	-.381	-.279	-.134	-.120	-.057	.011	.144
S2T	.192		.442	.416	.295	.146	.123	.079					

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	327.30	322.79	309.54	308.72	286.89	286.56	270.98	270.51	262.47	257.49	290.33

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	14.74	14.82	14.89	14.93	14.95	14.97	15.00	15.02	15.03	15.03	15.05	15.06	15.09

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	15.10	15.11	15.13	15.13	15.14	15.14	15.14	15.15	15.15	15.15	15.13	15.07

TABLE VII

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 24- 6 CONF. L5 C1 E8 B3 PWT T1 R1 RE THETA 3/4 =29.0 DEG N = 7500 RPM

M = 2132 PSF PINF = 2116.87 PSF TSC = 76 DEG F RHO = .00230 SLUGS/CU FT

MINF = .1009 VINF = 114.61 FPS QU = 14.888 PSF Q = 15.094 PSF

SHROUD SURFACE PRESSURE COEFFICIENTS

	LE0	01	02	04	06	08	10	125	15	175	20	25	
S1B	-1.575	-7.478	-8.853	-12.743	-15.237	-15.710	-15.701	-13.716	-11.629	-10.979	-9.831	-9.984	
S2T		.779	1.003	.435	.372	.318	.313	.280	.304	.273	.330		
	30	35	40	50	60	70	80	90	92	94	96	98	TE0
S1B	-9.130	-7.830	-7.145	-4.113	-2.817	-1.760	-.565	-.394	-.156	-.180	-.113	-.010	.147
S2T	.512		.587	.420	.294	.144	.149	.078					

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	389.20	382.28	364.50	364.94	334.38	334.67	315.02	314.82	304.43	298.51	340.28

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	14.74	14.82	14.90	14.97	15.00	15.04	15.07	15.10	15.11	15.12	15.14	15.16	15.20
ORIF.	14	15	16	17	18	19	20	21	22	23	24	25	
PRES.	15.22	15.24	15.26	15.27	15.28	15.29	15.32	15.33	15.33	15.33	15.29	15.21	

TABLE VII

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 55- 3 CONF. L4 C1 E7 B3 PNT T2 R1 RE T2 THETA 3/4 =43.0 DEG N = 7001 RPM

H = 2109 PSF PINF = 1875.89 PSF TSC = 84 DEG F RHO = .00207 SLUGS/CU FT

MINF = .4125 VINF = 464.55 FPS QU = 211.030 PSF Q = 223.438 PSF

SHROUD PRESSURE COEFFICIENTS

	LEO	01	02	04	06	08	10	125	15	175	20	25	
S.S	.986	.189	.107	.078	.052	.042	.045	.035	.027	.050	.006	-.021	
S.T		.196	.064	.055	.022	.002	.011	-.002	-.029	-.042	-.046	-.061	
	30	35	40	50	60	70	80	90	92	94	96	98	TEO
S.S	.015	.015	.242	.365	.373	.372	.367	.346	.347	.342	.330	.296	.315
S.T	-.056	-.074	-.092	-.096	-.065	-.002	.079	.151					

VII-10

INLET VELOCITIES, FPS

OR.F.	01	03	04	06	07	09	10	12	13	15	AVE
VE.	454.40	461.17	443.28	449.62	451.65	459.50	449.31	450.92	422.06	450.09	449.20

EXIT TOTAL PRESSURES, PSIA

OR.F.	01	02	03	04	05	06	07	08	09	10	11	12	13
PR.S.	14.54	14.70	14.87	14.96	15.00	15.04	15.10	15.17	15.24	15.30	15.36	15.40	15.43

OR.F.	14	15	16	17	18	19	20	21	22	23	24	25
PR.S.	15.44	15.43	15.42	15.39	15.36	15.33	15.27	14.43	14.64	14.65	14.65	14.65

TABLE VII

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 55- 4 CON. L4 C1 E7 B3 PNT T2 R1 RE TP THETA 3/4 =43.0 DEG N = 4304 RPM

H = 2109 PSF PINF = 1875.51 PSF TSC = 84 DEG F RHO = .00207 SLUGS/CU FT

MINF = .4129 VINF = 464.95 FPS QU = 211.364 PSF Q = 223.793 PSF

SHROUD PRESSURE COEFFICIENTS

	LED	01	02	04	06	08	10	125	15	175	20	25	
S.S	-.403	.780	.608	.499	.434	.405	.384	.354	.337	.327	.308	.275	
S.T		-.424	-.355	-.206	-.178	-.169	-.137	-.129	-.139	-.138	-.139	-.139	
	30	35	40	50	60	70	80	90	92	94	96	98	TEO
S.S	.276	.223	.249	.309	.292	.289	.292	.284	.278	.275	.268	.248	.290
S.T	-.131	-.136	-.152	-.152	-.118	-.034	.037	.120					

INLET VELOCITIES, FPS

OR.F.	01	03	04	06	07	09	10	12	13	15	AVE
VE.	374.00	379.36	369.45	372.14	379.99	385.94	383.21	386.35	376.86	392.04	379.94

EXIT TOTAL PPESSURES, PSIA

OR.F.	01	02	03	04	05	06	07	08	09	10	11	12	13
PR.S.	14.26	14.43	14.58	14.70	14.73	14.73	14.73	14.74	14.75	14.75	14.75	14.74	14.74

OR.F.	14	15	16	17	18	19	20	21	22	23	24	25
PR.S.	14.73	14.73	14.72	14.70	14.69	14.67	14.65	13.90	14.64	14.64	14.65	14.65

TABLE VII

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 55- 5 CONF. L4 C1 E7 B3 PNT T2 R1 RE TP THETA 3/4 =43.0 DEG N = 5503 RPM

H = 2109 PSF PI F = 1876.02 PSF TSC = 84 DEG F RHO = .00207 SLUGS/CU FT

MINF = .4124 VI F = 464.42 FPS QU = 210.922 PSF Q = 223.324 PSF

SHROUD PRESSURE COEFFICIENTS

	LEO	01	02	04	06	08	10	125	15	175	20	25	
S.B	.314	.604	.460	.362	.311	.282	.272	.252	.238	.260	.206	.171	
S.T		-.180	-.186	-.103	-.099	-.095	-.072	-.074	-.091	-.100	-.099	-.106	
	30	35	40	50	60	70	80	90	92	94	96	98	TEO
S.B	.180	.139	.235	.311	.319	.319	.317	.301	.302	.298	.289	.265	.274
S.T	-.095	-.111	-.126	-.126	-.093	-.027	.055	.127					

INLET VELOCITIES, FPS

OR.F.	01	03	04	06	07	09	10	12	13	15	AVE
VE.	402.11	407.73	395.08	396.84	404.08	410.23	405.11	407.69	391.35	410.38	403.06

EXIT TOTAL PRESSURES, PSIA

OR.F.	01	02	03	04	05	06	07	08	09	10	11	12	13
PR.S.	14.40	14.51	14.64	14.76	14.84	14.88	14.90	14.92	14.92	14.92	14.93	14.94	14.95

OR.F.	14	15	16	17	18	19	20	21	22	23	24	25
PR.S.	14.94	14.93	14.93	14.93	14.92	14.89	14.85	14.10	14.64	14.65	14.65	14.64

TABLE VII

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 56- 3 CONF. L4 C1 E7 B3 PNT T2 R1 RE TP THETA 3/4 =43.0 DEG N = 7001 RPM

H = 2111 PSF PINF = 1614.65 PSF TSC = 96 DEG F RHO = .00182 SLUGS/CU FT

MINF = .6308 VINF = 702.90 FPS QU = 424.819 PSF Q = 449.799 PSF

SHROUD PRESSURE COEFFICIENTS

	LEO	01	02	04	06	08	10	125	15	175	20	25	
S.B	.099	.781	.620	.503	.439	.410	.389	.368	.346	.464	.649	.277	
S.T		-.362	-.353	-.204	-.179	-.168	-.132	-.128	-.141	-.148	-.144	-.148	
	30	35	40	50	60	70	80	90	92	94	96	98	TEO
S.B	.282	.233	.267	.331	.329	.330	.331	.315	.311	.310	.299	.277	.295
S.T	-.136	-.146	-.163	-.170	-.126	-.044	.048	.133					

INLET VELOCITIES, FPS

OR.F.	01	03	04	06	07	09	10	12	13	15	AVE
VE.	561.56	570.01	558.01	563.14	571.77	577.52	573.74	577.90	559.93	583.21	569.68

EXIT TOTAL PRESSURES, PSIA

OR.F.	01	02	03	04	05	06	07	08	09	10	11	12	13
PR.S.	13.86	14.17	14.51	14.78	14.93	14.96	14.97	14.99	15.00	15.00	15.02	15.02	15.02
OR.F.	14	15	16	17	18	19	20	21	22	23	24	25	
PR.S.	15.01	14.99	14.95	14.87	14.83	14.80	14.70	13.15	14.66	14.66	14.66	14.66	

TABLE VII

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 56- 4 CONF. L4 C1 E7 B3 PNT T2 R1 RE TP THETA 3/4 =43.0 DEG N = 6303 RPM

H = 2111 PSF PINF = 1614.86 PSF TSC = 96 DEG F RHO = .00182 SLUGS/CU FT

MINF = .6307 VINF = 702.74 FPS QU = 424.664 PSF Q = 449.634 PSF

SHROUD PRESSURE COEFFICIENTS

	LEO	01	02	04	06	08	10	125	15	175	20	25	
S.B	.141	.824	.661	.540	.477	.444	.424	.396	.380	.466	.651	.305	
S.T		-.466	-.422	-.250	-.216	-.201	-.164	-.153	-.164	-.168	-.166	-.169	
	30	35	40	50	60	70	80	90	92	94	96	98	TEO
S.B	.311	.256	.261	.318	.318	.317	.319	.301	.296	.293	.285	.262	.284
S.T	-.157	-.163	-.183	-.186	-.143	-.052	.036	.122					

INLET VELOCITIES, FPS

OR.F.	01	03	04	06	07	09	10	12	13	15	AVE
VE.	549.04	556.67	546.43	552.04	560.52	565.39	562.83	567.23	551.42	573.65	558.52

EXIT TOTAL PRESSURES, PSIA

OR.F.	01	02	03	04	05	06	07	08	09	10	11	12	13
PR.S.	13.80	14.19	14.51	14.75	14.81	14.81	14.83	14.84	14.86	14.86	14.86	14.84	14.84

OR.F.	14	15	16	17	18	19	20	21	22	23	24	25
PR.S.	14.83	14.82	14.81	14.78	14.71	14.66	14.70	13.00	14.65	14.66	14.66	14.66

TABLE VII

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 57- 5 CONF. L4 C1 E7 B3 PNT T2 R1 RE TP THETA 3/4 =32.0 DEG N = 7003 RPM

H = 2111 PSF PINF = 1875.38 PSF TSC = 88 DEG F RHO = .00206 SLUGS/CU FT

MINF = .4147 VINF = 466.64 FPS QU = 213.209 PSF Q = 225.746 PSF

SHROUD PRESSURE COEFFICIENTS

	LEO	01	02	04	06	08	10	125	15	175	20	25	
S.B	.061	.684	.523	.426	.356	.338	.314	.304	.279	.014	.272	.230	
S.T		-.237	-.232	-.127	-.115	-.110	-.082	-.084	-.095	-.103	-.100	-.101	
	30	35	40	50	60	70	80	90	92	94	96	98	TEO
S.B	.241	.198	.220	.305	.310	.312	.316	.301	.295	.298	.286	.267	.285
S.T	-.098	-.107	-.111	-.125	-.086	-.016	.060	.144					

INLET VELOCITIES, FPS

OR.F.	01	03	04	06	07	09	10	12	13	15	AVE
VE.	391.75	397.46	386.35	389.99	397.12	402.80	399.71	402.17	390.13	406.63	396.41

EXIT TOTAL PRESSURES, PSIA

OR.F.	01	02	03	04	05	06	07	08	09	10	11	12	13
PR.S.	14.36	14.50	14.67	14.81	14.88	14.90	14.91	14.92	14.91	14.92	14.92	14.92	14.92
OR.F.	14	15	16	17	18	19	20	21	22	23	24	25	
PR.S.	14.91	14.90	14.88	14.80	14.80	14.73	14.66	13.92	14.66	14.66	14.66	14.66	

TABLE VII

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 57- 6 CONF. L4 C1 E7 B3 PNT T2 R1 RE TP THETA 3/4 =32.0 DEG N = 6003 RPM

H = 2111 PSF PINF = 1877.65 PSF TSC = 88 DEG F RHO = .00206 SLUGS/CU FT

MINF = .4125 VINF = 466.28 FPS QU = 211.252 PSF Q = 223.674 PSF

SHROUD PRESSURE COEFFICIENTS

	LEO	01	02	04	06	08	10	125	15	175	20	25	
S.B	-.692	.820	.658	.536	.468	.435	.412	.386	.374	.006	.287	.316	
S.T		-.521	-.410	-.239	-.205	-.187	-.152	-.138	-.149	-.148	-.147	-.146	
	30	35	40	50	60	70	80	90	92	94	96	98	TEO
S.B	.323	.279	.233	.300	.285	.286	.288	.268	.266	.265	.260	.240	.273
S.T	-.133	-.137	-.159	-.152	-.119	-.042	.030	.115					

INLET VELOCITIES, FPS

OR.F.	01	03	04	06	07	09	10	12	13	15	AVE
VE.	367.24	372.12	363.13	366.98	375.81	380.63	379.11	382.57	375.70	388.10	375.14

EXIT TOTAL PRESSURES, PSIA

OR.F.	01	02	03	04	05	06	07	08	09	10	11	12	13
PR.S.	14.29	14.48	14.62	14.71	14.72	14.72	14.73	14.73	14.74	14.72	14.73	14.72	14.73
OR.F.	14	15	16	17	18	19	20	21	22	23	24	25	
PR.S.	14.72	14.70	14.67	14.64	14.61	14.57	14.54	13.81	14.66	14.66	14.66	14.66	

TABLE VII

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 57- 7 CONF. L4 C1 E7 83 PNT T2 R1 RE TP THETA 3/4 =32.0 DEG N = 8000 RPM

H = 2111 PSF PINF = 1875.99 PSF TSC = 88 DEG F RHO = .00206 SLUGS/CU FT

MINF = .4141 VINF = 468.00 FPS QU = 212.680 PSF Q = 225.185 PSF

SHROUD PRESSURE COEFFICIENTS

	LEO	01	02	04	06	08	10	125	15	175	20	25	
S.B	.520	.535	.383	.310	.257	.248	.222	.211	.199	.014	.279	.156	
S.T		-.099	-.139	-.070	-.068	-.076	-.054	-.057	-.074	-.087	-.084	-.096	
	30	35	40	50	60	70	80	90	92	94	96	98	TEO
S.B	.175	.141	.206	.304	.324	.326	.325	.310	.301	.304	.290	.273	.277
S.T	-.087	-.096	-.107	-.119	-.080	-.011	.061	.139					

INLET VELOCITIES, FPS

OR.F.	01	03	04	06	07	09	10	12	13	15	AVE
VE.	415.15	420.17	406.86	411.51	417.41	423.99	418.94	422.27	407.03	425.00	416.83

EXIT TOTAL PRESSURES, PSIA

OR.F.	01	02	03	04	05	06	07	08	09	10	11	12	13
PR.S.	14.50	14.64	14.78	14.91	15.01	15.05	15.08	15.11	15.12	15.13	15.13	15.13	15.13

OR.F.	14	15	16	17	18	19	20	21	22	23	24	25
PR.S.	15.13	15.10	15.07	15.00	14.92	14.83	14.78	14.04	14.66	14.66	14.66	14.66

TABLE VII

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 58- 3 CONF. L4 C1 E7 B3 PNT T2 R1 RE TP THETA 3/4 =30.0 DEG N = 7003 RPM

H = 2111 PSF PINF = 2049.33 PSF TSC = 81 DEG F RHO = .00222 SLUGS/CU FT

MINF = .2062 VINF = 234.54 FPS QU = 57.630 PSF Q = 61.019 PSF

SHROUD PRESSURE COEFFICIENTS

	LEO	01	02	04	06	08	10	125	15	175	20	25	
S.B	.341	-1.556	-1.165	-.860	-.786	-.717	-.648	-.629	-.598	-2.717	-.617	-.629	
S.T		.860	.597	.418	.341	.287	.240	.204	.157	.134	.115	.084	
	30	35	40	50	60	70	80	90	92	94	96	98	TEO
S.B	-.562	-.550	-.093	.370	.444	.448	.444	.411	.413	.406	.383	.324	.279
S.T	.054	.039	-.008	-.019	-.038	.038	.119	-.200					

INLET VELOCITIES, FPS

OR.F.	01	03	04	06	07	09	10	12	13	15	AVE
VE.	294.41	297.14	281.46	284.66	285.54	290.38	281.05	279.31	258.17	275.61	282.77

EXIT TOTAL PRESSURES, PSIA

OR.F.	01	02	03	04	05	06	07	08	09	10	11	12	13
PR.S.	14.75	14.89	14.97	15.03	15.05	15.07	15.08	15.09	15.10	15.12	15.15	15.16	15.16
OR.F.	14	15	16	17	18	19	20	21	22	23	24	25	
PR.S.	15.16	15.16	15.16	15.15	15.14	15.10	15.06	14.71	14.66	14.66	14.66	14.66	

TABLE VII

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 58- 4 CONF. L4 C1 E7 B3 PNT T2 R1 RE TP THETA 3/4 =30.0 DEG N = 6002 RPM

H = 2111 PSF PINF = 2052.23 PSF TSC = 81 DEG F RHO = .00222 SLUGS/CU FT

MINF = .2012 VINF = 228.89 FPS QU = 54.945 PSF Q = 58.176 PSF

SHROUD PRESSURE COEFFICIENTS

	LEO	01	02	04	06	08	10	125	15	175	20	25
S.B	.973	-.532	-.427	-.340	-.305	-.310	-.280	-.300	-.265	-2.897	-.268	-.301
S.T		.514	.292	.188	.104	.068	.046	.033	-.016	-.031	-.045	-.062

	30	35	40	50	60	70	80	90	92	94	96	98	TEO
S.B	-.263	-.286	.021	.348	.371	.374	.379	.321	.331	.319	.314	.272	.255
S.T	-.060	-.089	-.112	-.102	-.095	-.040	.052	.115					

INLET VELOCITIES, FPS

OR.F.	01	03	04	06	07	09	10	12	13	15	AVE
VE.	255.17	258.17	245.09	246.66	251.21	253.78	248.49	249.27	233.96	245.55	248.74

EXIT TOTAL PRESSURES, PSIA

OR.F.	01	02	03	04	05	06	07	08	09	10	11	12	13
PR.S.	14.70	14.80	14.86	14.89	14.90	14.91	14.93	14.94	14.94	14.95	14.96	14.97	14.98

OR.F.	14	15	16	17	18	19	20	21	22	23	24	25
PR.S.	14.97	14.97	14.97	14.96	14.93	14.88	14.87	14.61	14.66	14.66	14.66	14.66

TABLE VII

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 58- 5 CONF. L4 C1 E7 B3 PNT T2 R1 RE TP THETA 3/4 =30.0 DEG N = 8001 RPM

H = 2111 PSF PINF = 2050.56 PSF TSC = 81 DEG F RHO = .00222 SLUGS/CU FT

MINF = .2041 VINF = 232.17 FPS QU = 56.495 PSF Q = 59.817 PSF

SHROUD PRESSURE COEFFICIENTS

	LEO	01	02	04	06	08	10	125	15	175	20	25
S.B	-1.201	-3.975	-2.257	-1.591	-1.406	-1.310	-1.227	-1.162	-1.120	-2.778	-1.050	-1.031
S.T		.984	.818	.593	.468	.387	.339	.284	.250	.190	.173	.123

	30	35	40	50	60	70	80	90	92	94	96	98	TEO
S.B	-.890	-.773	-.196	.416	.506	.518	.508	.453	.446	.444	.415	.372	.292
S.T	.109	.080	.028	-.009	.047	.075	.154	.187					

INLET VELOCITIES, FPS

OR.F.	01	03	04	06	07	09	10	12	13	15	AVE
VE.	332.65	337.32	316.53	322.34	319.87	326.05	314.69	312.92	285.70	306.55	317.46

EXIT TOTAL PRESSURES, PSIA

OR.F.	01	02	03	04	05	06	07	08	09	10	11	12	13
PR.S.	14.82	14.96	15.11	15.20	15.24	15.25	15.28	15.30	15.32	15.34	15.36	15.39	15.43

OR.F.	14	15	16	17	18	19	20	21	22	23	24	25
PR.S.	15.45	15.46	15.45	15.42	15.34	15.24	15.18	14.82	14.66	14.66	14.66	14.66

TABLE VII

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 59- 5 CONF. L4 C1 E7 B3 PNT T2 R1 RE TP THETA 3/4 =30.0 DEG N = 7002 RPM

H = 2112 PSF PINF = 2050.79 PSF TSC = 80 DEG F RHO = .00222 SLUGS/CU FT

MINF = .2054 VINF = 233.39 FPS QU = 57.207 PSF Q = 60.571 PSF

SHROUD PRESSURE COEFFICIENTS

	LEO	01	02	04	06	08	10	125	15	175	20	25	
S.B	.273	-1.633	-1.190	-.874	-.818	-.732	-.712	-.650	-.655	-2.717	-.644	-.656	
S.T		.846	.603	.414	.292	.226	.210	.151	.121	.083	.071	.046	
	30	35	40	50	60	70	80	90	92	94	96	98	TEO
S.B	-.611	-.575	-.126	.478	.437	.447	.445	.398	.393	.398	.388	.322	.395
S.T	-.027	-.011	.022	-.024	.008	.033	.135	.209					

INLET VELOCITIES, FPS

OR.F.	01	03	04	06	07	09	10	12	13	15	AVE
VE.	293.76	297.03	280.37	282.77	284.06	289.04	280.29	279.02	257.27	274.62	281.82

EXIT TOTAL PRESSURES, PSIA

OR.F.	01	02	03	04	05	06	07	08	09	10	11	12	13
PR.S.	14.77	14.89	14.99	15.03	15.05	15.07	15.09	15.11	15.11	15.13	15.15	15.17	15.17

OR.F.	14	15	16	17	18	19	20	21	22	23	24	25
PR.S.	15.17	15.17	15.17	15.17	15.16	15.12	15.07	14.72	14.67	14.67	14.66	14.66

TABLE VII

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 59- 6 CONF. L4 C1 E7 B3 PNT T2 R1 RE TP THETA 3/4 =30.0 DEG N = 6000 RPM

H = 2112 PSF PINF = 2049.38 PSF TSC = 80 DEG F RHO = .00222 SLUGS/CU FT

MINF = .2078 VINF = 236.09 FPS QU = 58.511 PSF Q = 61.951 PSF

SHROUD PRESSURE COEFFICIENTS

	LEO	01	02	04	06	08	10	125	15	175	20	25	
S.B	.945	-.395	-.367	-.257	-.285	-.229	-.224	-.215	-.227	-2.609	-.228	-.247	
S.T		.492	.270	.177	.108	.069	.060	.025	-.002	-.016	-.032	-.032	
	30	35	40	50	60	70	80	90	92	94	96	98	TEO
S.B	-.210	-.243	.031	.405	.356	.347	.365	.351	.344	.355	.348	.286	.388
S.T	-.058	-.058	-.059	-.084	-.079	.000	.075	.180					

INLET VELOCITIES, FPS

OR.F.	01	03	04	06	07	09	10	12	13	15	AVE
VE.	256.65	259.01	247.05	248.86	252.25	256.05	251.11	250.60	235.58	248.73	250.59

EXIT TOTAL PRESSURES, PSIA

OR.F.	01	02	03	04	05	06	07	08	09	10	11	12	13
PR.S.	14.71	14.81	14.87	14.89	14.92	14.94	14.94	14.94	14.95	14.96	14.98	14.99	14.98

OR.F.	14	15	16	17	18	19	20	21	22	23	24	25
PR.S.	14.97	14.97	14.97	14.96	14.94	14.90	14.87	14.61	14.67	14.66	14.66	14.66

TABLE VII

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 59- 7 CONF. L4 C1 E7 B3 PNT T2 R1 RE TP THETA 3/4 =30.0 DEG N = 8001 RPM

H = 2112 PSF PINF = 2050.14 PSF TSC = 80 DEG F RHO = .00222 SLUGS/CU FT

MINF = .2065 VINF = 234.62 FPS QU = 57.803 PSF Q = 61.202 PSF

SHROUD PRESSURE COEFFICIENTS

	LEO	01	02	04	06	08	10	125	15	175	20	25
S.B	-1.172	-3.848	-2.213	-1.546	-1.395	-1.234	-1.175	-1.084	-1.076	-2.664	-1.015	-.974
S.T		1.001	.813	.607	.498	.392	.355	.292	.252	.217	.186	.130

	30	35	40	50	60	70	80	90	92	94	96	98	TEO
S.B	-.846	-.732	-.148	.430	.544	.542	.523	.480	.466	.457	.421	.377	.367
S.T	.109	.086	.082	.022	.054	.114	.178	.240					

INLET VELOCITIES, FPS

OR.F.	01	03	04	06	07	09	10	12	13	15	AVE
VE.	331.84	336.04	316.35	322.38	320.48	328.28	315.77	313.06	285.61	307.72	317.75

EXIT TOTAL PRESSURES, PSIA

OR.F.	01	02	03	04	05	06	07	08	09	10	11	12	13
PR.S.	14.83	14.98	15.12	15.22	15.27	15.29	15.30	15.32	15.33	15.37	15.40	15.42	15.44

OR.F.	14	15	16	17	18	19	20	21	22	23	24	25
PR.S.	15.46	15.47	15.47	15.44	15.35	15.25	15.19	14.84	14.67	14.67	14.67	14.67

TABLE VII

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 80- 4 CONF. L4 C1 E6 B3 PNT T2 R1 RE TP THETA 3/4 =41.0 DEG N = 6500 RPM

H = 2090 PSF PINF = 1595.53 PSF TSC = 94 DEG F RHO = .00181 SLUGS/CU FT

MINF = .6332 VINF = 704.04 FPS QU = 422.904 PSF Q = 447.771 PSF

SHROUD PRESSURE COEFFICIENTS

	LE0	01	02	04	06	08	10	125	15	175	20	25
S1B	1.107	1.048	.922	.812	.753	.704	.681	.652	.627	.608	.785	.548
S2T		1.105	1.107	-.940	-.530	-.416	-.389	-.368	-.331	-.304	-.310	-.304

	30	35	40	50	60	70	80	90	92	94	96	98	TE0
S1B	.523	.479	.530	.603	.559	.540	.497	.627	1.075	.428	.385	.338	.293
S2T	-.279	-.252	-.243	-.216	-.165	-.049	.062	.155					

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	449.80	461.16	457.49	467.21	475.83	483.75	487.49	493.31	483.78	501.78	476.16

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	13.92	14.12	14.39	14.63	14.77	14.78	14.80	14.82	14.84	14.85	14.86	14.87	14.87

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	14.86	14.84	14.83	14.81	14.75	14.68	12.42	12.95	14.09	14.48	14.51	14.52

TABLE VII

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 80- 5 CONF. L4 C1 E6 B3 PNT T2 R1 RE TP THETA 3/4 =41.0 DEG N = 5504 RPM

H = 2090 PSF PINF = 1593.27 PSF TSC = 94 DEG F RHO = .00180 SLUGS/CU FT

MINF = .6349 VINF = 705.81 FPS QU = 424.610 PSF Q = 449.577 PSF

SHROUD PRESSURE COEFFICIENTS

	LEO	01	02	04	06	08	10	125	15	175	20	25	
S_{1B}	1.105	1.068	.951	.852	.785	.744	.718	.693	.666	.646	.785	.591	
S_{2T}		1.105	1.104	-1.217	-.836	-.554	-.432	-.376	-.338	-.311	-.311	-.299	
	30	35	40	50	60	70	80	90	92	94	96	98	TEO
S_{1B}	.566	.519	.517	.565	.521	.501	.465	.645	1.073	.405	.362	.318	.276
S_{2T}	-.278	-.252	-.240	-.218	-.166	-.053	.053	.152					

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	432.27	443.92	441.20	448.50	460.02	470.12	474.54	477.96	474.47	487.28	461.03

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	13.85	14.13	14.39	14.54	14.59	14.60	14.61	14.61	14.60	14.61	14.62	14.62	14.60

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	14.58	14.57	14.55	14.53	14.48	14.47	12.43	12.69	13.67	14.23	14.47	14.51

TABLE VII

HS VARIABLE GEOMETRY SHROUDED PROPELLER TEST

PRESSURE DATA

RUN-PT 80- 6 CONF. L4 C1 E6 B3 PNT T2 R1 RE TP THETA 3/4 =41.0 DEG N = 7501 RPM

H = 2090 PSF PINF = 1599.71 PSF TSC = 94 DEG F RHO = .00181 SLUGS/CU FT

MINF = .6300 VINF = 700.75 FPS QU = 419.748 PSF Q = 444.430 PSF

SHROUD PRESSURE COEFFICIENTS

	LE0	01	02	04	06	08	10	125	15	175	20	25
S1B	1.109	1.025	.889	.778	.716	.668	.644	.616	.591	.572	.781	.515
S2T		1.102	1.105	-.641	-.460	-.401	-.379	-.362	-.322	-.296	-.303	-.302

	30	35	40	50	60	70	80	90	92	94	96	98	TE0
S1B	.494	.459	.550	.617	.595	.574	.526	.652	1.074	.455	.406	.357	.281
S2T	-.276	-.250	-.232	-.211	-.160	-.045	.071	.163					

INLET VELOCITIES, FPS

ORIF.	01	03	04	06	07	09	10	12	13	15	AVE
VEL.	467.42	479.36	473.35	484.48	490.92	500.56	501.74	507.35	492.70	515.04	491.29

EXIT TOTAL PRESSURES, PSIA

ORIF.	01	02	03	04	05	06	07	08	09	10	11	12	13
PRES.	14.09	14.28	14.48	14.70	14.88	14.97	15.03	15.08	15.11	15.14	15.15	15.15	15.16

ORIF.	14	15	16	17	18	19	20	21	22	23	24	25
PRES.	15.15	15.12	15.08	15.04	14.98	14.89	12.44	13.25	14.40	14.51	14.52	14.52